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I - Experimental Performance

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and Space Administration

**Scientific and Technical
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SUMMARY

Aerodynamic performances of four stator-blade rows, each operated downstream of the same rotor are presented and evaluated. The rotor and flow path were a 0.5-meter-diameter model of the NASA QF-1 (tip speed, 337 m/sec; pressure ratio, 1.54). The aerodynamic designs of two of these stator-blade rows were compromised to reduce noise; a third design was not. The original stator for NASA QF-1, called S9, had a short chord because of the large number of blades required to achieve low noise. It also had relatively thick blades to allow casting. A second configuration, called S9R, was simply S9 reset, that is, the blades were closed 3.7°. The other two designs, S9C and S9D, had twice the chord of S9, had about half the number of blades, and were thinner. The radial distribution of incidence angle for S9C was skewed to satisfy a low-noise theory of minimum lift fluctuations. The S9D had no noise constraints but was patterned after a design that had demonstrated the best known performance at high inlet Mach numbers.

On a calculated operating line passing through the design point pressure ratio (which is also close to stator minimum loss operation) S9D had the best performance of those studied. Overall pressure-ratio and efficiency decrements across S9D were 0.031 and 0.044, respectively, providing a stage pressure ratio of 1.483 and efficiency of 0.865. The other stators showed some performance deficiencies, due partly to the design compromises for noise.

Detailed blade-element performance indicated that losses were significantly less in the endwall regions for the shorter chord blades. Also, in the midspan region air turning was more efficiently done with blade camber than with incidence angle.

Flow in the stator-hub region was of particular interest because it initiated stage stall at design speed. Near stall, the hub-element (90 percent span from tip) diffusion factors for all stators were about 0.47.

INTRODUCTION

The aerodynamic and acoustic performances of a single-stage fan with a tip speed of 337 meters per second and a pressure ratio of 1.50 have been extensively reported (refs. 1 to 7). In its 1.83-meter-diameter size (refs. 1 to 3), it has been designated the NASA QF-1 stage, and as a 0.5-meter-diameter scaled model (refs. 4 to 7), it is called stage 15-9 (for rotor 15-stator 9).

The NASA QF-1 was the first in a series of designs in support of NASA's low-noise, conventional aircraft engine program (ref. 8). All of those fan designs contained some unconventional geometric and aerodynamic features because of noise considerations. For example, not only is the QF-1 design low speed and single stage, but it has no inlet guide vanes and no part-span dampers. Also, it has large axial spacing between the rotor and stator (3.5-rotor chords) and a stator-blade-to-rotor-blade number ratio greater than two (112 to 53). Further, to attain the design pressure ratio the low tip speed requires relatively high blade loadings and high stator inlet Mach numbers. Detailed aerodynamic performance data from such designs helps to evaluate the noise-related design compromises. These data also provide design information on the effects of loading and inlet Mach number on blade performance in ranges of general interest.

Added understanding of blade-row performance is often obtained by comparing alternative designs. And the design and experimental evaluation of alternative stators, for example, is enhanced if (1) the rotor performance has already been documented, (2) stator inflow has not been distorted by rotor part-span dampers, (3) the stator is located several rotor-chord lengths downstream, and (4) the test facility, instrumentation, and data-reduction procedures are the same for all configurations. All of these features are in the present study of two alternative stator designs. Each redesigned stator had 60 blades, a chord length of 3.72 centimeters, and an aspect ratio of 2.6. Each stator-blade row was designed for operation behind the previously tested 0.5-meter-diameter rotor 15.

One new design, S9C, was motivated by an untried noise-reduction theory (ref. 9). This theory involves minimizing the fluctuating lift on the stator due to the velocity-varying oncoming flow from the rotor. The other new design, S9D, was not significantly compromised by any noise requirements; instead, it was patterned after a NASA-sponsored design that had demonstrated the best known performance at high inlet Mach numbers (ref. 10).

Overall and blade-element aerodynamic performances of S9C and S9D were obtained for the stable operating flow range at constant rotative speeds of 70, 90, and 100 percent of design and for near-stall conditions only at 50, 60, and 80 percent of design speed. Overall performances of stages 15-9C and 15-9D were also obtained.

The present study involves two parts, each of which is reported separately under the same general title. The purposes of the present report (Part I) and (1) to present the detailed aerodynamic data over a wide range of operation for two alternative stator designs for the NASA QF-1 rotor, (2) to compare these data with those from the original stator, and (3) to evaluate these performance results conventionally, that is, based on information outside the blade rows. The work reported herein also provided the data base for Part II (ref. 11). There, two-dimensional, inviscid-flow analysis codes are applied to the stator data. They provide new information about the flow within the blade row and on the blade surfaces. Some of the blade-surface information is then correlated with the conventionally measured performance of the three stator designs. Based on this additional insight, an improved stator design is proposed.

The symbols and equations used to define the performance parameters are given in appendixes A and B. The abbreviations and units used for the tabular data are defined in appendix C.

All work was done at the NASA Lewis Research Center.

APPARATUS AND PROCEDURES

Stage Designs

Four different single-stage configurations, involving three different stator designs, were used for the present report. The designs and performances of two of the configurations, 15-9 and 15-9R (for stator 9 reset, 3.7° closed) have been previously reported (ref. 4). The two new configurations involved two new stator designs, S9C and S9D, which are described in following sections.

The flow path and blading locations for all stages are shown in figure 1. The leading edges of S9 and S9R were 3.5 rotor chords (13.3 cm) downstream of the rotor trailing edge; those for S9C and S9D were 2.9 rotor chords downstream.

The overall design parameters for stage 15-9 are listed in table I (from ref. 4). These values also apply to the design of stages 15-9C and 15-9D, with one exception: A 1-point improvement in stage adiabatic efficiency is predicted with S9D because of reduced stator loss inputs that reflect more recent experience with a similar design (ref. 10). Nominal design values for all stages were tip speeds of 337 meters per second, pressure ratios of 1.5, efficiencies of 0.85 (0.86 with S9D), and weight flows of 29.16 kilograms per second (201.8 kg/sec m^2 of annulus area).

Rotor-Blade Design

The design blade-element aerodynamics and geometry for rotor 15 are presented in tables II and III (both from ref. 4). The rotor, shown in figure 2, has 53 blades with a chord of 3.80 centimeters and an aspect ratio of 3.0. It has an inlet hub-to-tip ratio of 0.5 and no part-span damper is required for structural stability. The computer codes used to design rotor 15, as well as the stators, are essentially those previously described in reference 4.

Stator-Blade Designs

The blade section shapes for all designs are from the multiple-circular-arc family (ref. 12). A brief description of each design follows.

Stator 9. - The design blade-element aerodynamics and geometry of S9 are presented in tables IV and V (from ref. 4). A photograph of S9 and its mounting rings is shown in figure 3. There are 112 blades with a chord of 1.85 centimeters and an aspect ratio of 5.1. The blades were held at each end by slotted mounting rings. Electrical discharge machining made these slots conform to the blade-end sections. A second set of mounting rings was slotted at a different blade setting angle (angle between aerodynamic chord and the meridional plane). This alternative setting was closed 3.7° from the original design to reduce stator incidence angle. This stator configuration is called S9R.

The radial distribution of many of the design features of S9 are shown in figure 4, along with those for S9C and S9D to be discussed next. The coordinates and camber distributions for S9 are shown in figure 5 for blade sections near the tip, mean, and hub.

Stator 9C. - The design of S9C was motivated by a noise-reduction theory (ref. 9) that involves minimizing the fluctuating lift forces on airfoils due to changes in oncoming velocities (gusts). Details of such a design, involving both rotor and stator blading and intended to satisfy the same aerodynamic goals as those for the NASA QF-1 stage, have been reported (ref. 13). Noise results of a similar design are found in reference 14. The present application involved a redesigned stator only.

The main noise related changes for S9C compared with S9 were a doubling of the chord and a different incidence-angle distribution across the span. This in turn necessitated some reductions in blade thicknesses and camber distribution to pass the required weight flow at the various spanwise sections. These design changes are summarized in figure 4.

The blade solidity for S9C was held nearly the same as for S9, but the chord for S9C was increased to increase the reduced-frequency parameter. The longer chord reduced the response of the airfoil to the oncoming velocity variations and thus the fluctuating lift. Incidence angle at each spanwise blade element was also selected to minimize the airfoils response to gusts. Even greater incidence-angle differences between tip and hub for S9C were desirable according to the noise theory; however, limits were set to the values shown in figures 4(a) and (b) to avoid premature stall.

Fabrication restrictions were eased for S9C from those of S9. (The S9 restrictions are described in the footnote to table V.) However, the absolute value of edge radii, 0.013 centimeter (0.005-in.) for S9C, was a fabrication limit. This edge limit was used along with maximum thickness reductions from S9 of up to 25 percent at the hub. About one-third of this reduction was to counteract the thickness added to the S9 design for fabrication purposes. The remaining reduction was to enlarge the flow areas to pass the required flow. The resulting camber distribution for S9C (fig. 4(h)) resulted from both choke margin and incidence-angle considerations.

The design blade-element aerodynamics and geometry for S9C are given in tables VI and VII, respectively. A photograph of one-half the blades and rings assembly is shown in figure 6. There are 60 blades, with chords of 3.72 centimeters, and aspect ratios of 2.6. The mounting rings were machined to match and hold the blade end sections. Typical coordinates and camber distributions for S9C are shown in figure 7.

Stator 9D. - The S9D design was patterned after a successful one developed under NASA contract (ref. 10) for use with an existing, but somewhat different rotor and flow path. Although the contract called for a low-speed, high-loading fan stage for low-noise application, its stator design was not significantly compromised by noise requirements. It should be noted, however, that the S9D design with the present rotor would not meet noise requirements because of the stator-to-rotor blade number ratio.

The blade tip solidity (1.52) and aspect ratio (2.6) of S9D were close to those of reference 10, and the resulting chord length (3.72 cm) and blade number (60) were the same as for S9C. Camber distribution, incidence angles, and thickness distributions copied the referenced stator as closely as possible. The edge radii of 0.013 centimeter were a fabrication limit. The loss set used in the S9D design process came from test results (ref. 10), and the deviation angles were determined from a modified Carter's rule (described in ref. 15).

The design blade-element aerodynamics and geometry for S9D are presented in tables VIII and IX. A photograph of one-half the S9D blades and rings assembly is shown in figure 8. There are 60 blades with chords of 3.72 centimeters and aspect ratios of 2.6. These blades were mounted in the same manner as for S9 and S9C.

The incidence angles to the mean line for S9D (fig. 4(a)) are much nearer zero across the span, than for S9 or S9C. Recent data from the first stator row of a two-stage fan (ref. 16 and other sources) indicate that minimum loss does occur near zero incidence angle to the mean for blade shapes, solidities, and stator inlet Mach numbers like those for the present stators.

Many blade designs, like S9, have been based on zero incidence angle to the suction surface. This is to minimize the suction-surface Mach numbers, which might be high enough to cause significant shock losses. This approach was also applied in the high inlet-Mach-number hub region of S9D. However, such a design rule can be misapplied with relatively thick blade sections like S9 where it resulted in relatively high incidence angles to the mean line. Such high incidence angles usually result in higher losses or less flow range, or both. The thinner S9D blades avoid this problem in the hub region. In the tip region the S9D incidence angles were based on unpublished data correlations.

Transition location (fig. 4(g)) and inlet-to-outlet turning-rate ratio (fig. 4(h)) affect the blades peak suction-surface velocity and thus its loss (ref. 11). They also affect the flow-area distribution through the blade row and thus its choke margin. These geometry features differ for S9, S9C, and S9D. The camber distributions for S9D are shown in figure 9. They can be compared with those for S9C and S9 in figures 7 and 5. Front camber near the hub is only 8.3° for S9D compared with 20.0° for S9C and 14.5° for S9. This lower front camber for S9D tended to lower the peak suction-surface velocity and thus loss. At the same time, however, it contributed to its much lower design choke margin over the inner half-span (fig. 4(i)). A design compromise was made between these conflicting trends.

Compressor Test Facility

The test facility is the same as that described in reference 17 and was used with stage 15-9 of reference 4. A schematic view of the facility is shown in figure 10.

Instrumentation

The instrumentation used in testing stage 15-9C and 15-9D was the same as used for stage 15-9 (ref. 4) with the following exceptions: To determine static pressure, two 18° wedge probes with straight stems (fig. 11(c)) were used at all measuring stations for stage 15-9D instead of the 8° wedge probes with hooked stems (fig. 11(b)). This avoided probe interference with the leading edge of stator S9D at measuring station 2b' (fig. 1). Surveys between blade rows were taken at station 2a for stage 15-9C and at station 2b' for stage 15-9D.

Two combination probes for determining total pressure, total temperature, and flow angle (fig. 11(a)) and two wedge probes for determining static pressure (figs. 11(b) and (c)) were used at each measuring station. The probes were located approximately 90° apart, with the two like probes opposite each other (fig. 12). In testing stages 15-9C and 15-9D the combination probes at station 3 were circumferentially traversed 6° (one stator-blade gap) from the nominal values indicated in figure 12.

The estimated errors of the data, based on inherent accuracies of the instrumentation and recording system are as follows:

Weight flow, kg/sec	± 0.3
Rotative speed, rpm	± 30
Flow angle, deg	± 1
Temperature, K	± 0.6
Rotor-inlet total pressure, N/cm^2	± 0.01

Rotor-outlet total pressure, N/cm^2	±0.07
Stator-outlet total pressure, N/cm^2	±0.07
Rotor-inlet static pressure, N/cm^2	±0.04
Rotor-outlet static pressure, N/cm^2	±0.04
Stator-outlet static pressure, N/cm^2	±0.04

Further details of the instrumentation can be found in reference 4.

Test and Calculation Procedures

The test procedure for stages 15-9C and 15-9D was the same as that described for stage 15-9 in reference 4. The calculation procedure for stages 15-9C and 15-9D was the same as that described for stage 15-9 (ref. 4) with the following exceptions:

For spanwise locations near the hub and shroud, static pressures were determined directly from the straight-stemmed 18° wedge probe. The hooked-stemmed 8° wedge probe used with stage 15-9 required an interpolation to measured wall static values.

A different definition of stator-loss coefficient was used to minimize inaccuracies and the effects of different upstream measuring stations on indicated loss levels. Interblade row station 2a and then 2b were used to measure the rotor and stator performances of stages 15-9 and 15-9R (see fig. 1), with the result that small but consistent differences in indicated blade-row performances were obtained (see ref. 4).

Stage 15-9C used station 2a because that location is typical for other stages tested in the same facility. Stage 15-9D used station 2b' to insure that all rotor wake mixing would be complete and to better identify stator performance. To eliminate the differences in indicated stator performance due to difference in the location of station 2, the value of $\left(P'_{id}\right)_{TE}$ in the loss coefficient (eq. (B9)) was obtained from station 3, common to all configurations. An average of the three highest total pressures measured across the stator gap by the circumferential surveys at station 3 set the value of $\left(P'_{id}\right)_{TE}$. This is equivalent to assuming no loss in free-stream total pressure across the stator blade row. Such a definition has been used by others (e.g., refs. 18 and 19) and has sometimes been called the wake total-pressure-loss coefficient (ref. 20).

In this report the symbol $\bar{\omega}_w$ denotes that station 3 values were used to determine $\left(P'_{id}\right)_{TE}$, and $\bar{\omega}$ that station 2 values were used. Both values of stator-loss coefficient are given in the blade-element tabulations. The table headings are TOT LOSS COEFF, WAKE for $\bar{\omega}_w$, and LOSS COEFF TOT for $\bar{\omega}$.

RESULTS AND DISCUSSION

Overall performances of stages 15-9, 15-9R, 15-9C, and 15-9D are presented and discussed first. The overall performances of the rotor and then of the stators are next. Finally, the blade-element performances of all the stators are discussed.

Overall Performance

The overall performance parameters for the stages are listed in tables X to XIII. Stage overall performance is also graphically presented in figures 13 to 16. Rotor 15 performance with the various stators is shown in figure 17. The performance decrements across the different stators are presented in figure 18.

One way of comparing the overall performances of figures 13 to 18 is tabulated below. This comparison was made at design speed and at a weight flow where a calculated operating line (approximating that of an aircraft-installed fan with fixed-exit nozzle, see ref. 4) passes through the design-point pressure ratio. Also, for the present data, this reference point is close to the minimum overall loss condition for each blade row.

Stage designation	Stage total-pressure ratio	Stage temperature-rise efficiency	Stage stall margin, percent	Pressure-ratio decrement across stator[a]	Efficiency decrement across stator[a]	Percent design flow
Rotor 15 - stator 9	1.475	0.835	4	0.033	0.057	98.0
Rotor 15 - stator 9R	1.482	.845	[b]11	.031	.045	98.6
Rotor 15 - stator 9C	1.475	.830	[b]8	[c].038	[c].056	98.0
Rotor 15 - stator 9D	1.483	.865	[b]12	.031	.044	98.7
Design values	1.50	.85	---	.042	.060	100.0

[a] Based on measuring stations 2b and 3 (fig. 1).

[b] Stall margins greater than about 4 percent were dependent on a positive-slope pressure-flow characteristic at design speed caused by high rotor losses. These higher stall margins are not considered usable in a practical application (see ref. 4).

[c] Includes estimated difference between stations 2a and 2b.

All stages compare favorably with the design values, with stage 15-9D the best of the four. The listed differences in stage efficiency are not generally the same as the differences in efficiency decrements across the stator. As shown in figure 17, rotor 15 performance values are somewhat different when tested with the different stators. Aside from the differences due to measuring station (ref. 4), the differing rotor performance is believed due to different installations of the rotor.

Stages 15-9 and 15-9R were tested within days of each other, and the stator reset was done without reinstalling the rotor. Stages 15-9C and 15-9D were each studied in separate test programs, months apart, and each required reinstalling the rotor. Because the emphasis in this report is on stator performance, decrements in overall pressure ratio and efficiency across the various stators (fig. 18) were used to minimize any effects of varying rotor performance due to different installations. Thus the overall performances of the different stators will be compared on this basis.

Stator 9D had the lowest pressure-ratio and efficiency decrements (0.031 and 0.044, respectively). The shorter-chord S9R exhibited the same low values but left some swirl in the exit flow due to the 3.7° reset. Without reset (S9) the pressure-ratio and efficiency decrements were 0.033 and 0.057. The efficiency decrement across S9C was about 0.056; it has the same chord as S9D. The S9 and S9C designs were strongly influenced by low-noise considerations and performed about 1 point lower in overall efficiency than the S9D design, which was essentially independent of noise constraints. However, such a penalty need not be inherent to all low-noise designs.

The present stator comparison (on the calculated operating line) shows that all designs were operating near their minimum overall pressure decrement except for S9C (fig. 18). The performance of S9C is continuing to improve as weight flow is increased. However, the rotor limits the maximum possible flow to about 100.5 percent of design. This was demonstrated by the rotor-only tests discussed in reference 4. Thus, the additional flow range available for S9C operation is not enough to significantly improve its measured performance. However, without such rotor-choke limitations, S9C performance at the higher flows could fall between that for S9 and S9D.

The varying stage stall margins at design speed (see previous tabulation) with the different stators indicate the stator initiated stage stall. This was also confirmed by rotor-alone tests (ref. 4). Stator hub-element loadings (D factors) near stall were correlated for S9 and S9R in reference 4. Similar results for S9C and S9D will be discussed in a subsequent section.

Stator-Element Performance

Blade-element data tabulations for S9C and S9D are given in tables XIV and XV, respectively. Similar tabulations for S9 and S9R appear in reference 4. An error, discovered in a small portion of the S9R blade-element data of reference 4 (readings 704, 707, and 709), resulted from an improper translation of measured data to the leading edge. The corrected data appear here in table XVI. Generally, both $\bar{\omega}_w$ and $\bar{\omega}$ values of loss coefficient are presented in the tables. Loss coefficients for S9 and S9R were previously reported only as $\bar{\omega}$. Their $\bar{\omega}_w$ values are presented here in tables XVII and XVIII.

The stator blade-element performances are discussed in the following subsections.

Effect of free-stream reference station on indicated loss. - In a previous section (see Test and Calculation Procedures), some of the reasons for selecting station 3 for the free-stream reference for stator loss levels are discussed. In figure 19 typical loss variations with reference station are shown. Radial distributions of stator total-loss coefficient, both $\bar{\omega}_w$ and $\bar{\omega}$, at design speed and nearly the same weight flow (near peak stage efficiency) are given. Between about 15- and 85-percent span, there is usually reasonable agreement between $\bar{\omega}_w$ and $\bar{\omega}$, except for S9C. With that stator, station 2a is much closer to the rotor than station 2b (fig. 1), used with the others, and rotor-wake mixing losses may still be evident there. This would result in the somewhat higher apparent stator-loss coefficients $\bar{\omega}_{2a}$, as shown. The remaining disagreement in this midspan region is believed due to the greater data scatter using the $\bar{\omega}$ definition. As an example, the value of $\bar{\omega}$ indicated for S9D at 70 percent span (fig. 19(d)) is unrealistically low. In contrast, $\bar{\omega}_w$ values exhibit much less radial variation and, although not shown here, much less data scatter over an operating range for a particular spanwise location than do the $\bar{\omega}$ values. This applies to all stators tested.

In both end-wall regions $\bar{\omega}_w$ is usually less than $\bar{\omega}$, particularly for S9C, which has the longer end-wall flow from station 2a. There are also three-dimensional flow effects in the end-wall regions, especially with the longer chord S9C and S9D designs, which cause a reduction in total pressure in the free-stream flow from inlet to outlet. This also lowers the level of $\bar{\omega}_w$. Thus, absolute values of $\bar{\omega}_w$ near the walls may not be accurate measures of total loss to be charged to the stator. However, relative values there are believed useful.

As previously discussed, the effects of different upstream measuring stations on indicated loss levels can be minimized by using the stator exit (station 3) as a reference. Such a reference also reduces data scatter, thus improving chances of correlation. For these reasons the $\bar{\omega}_w$ definition of wake total-loss coefficient, and its ally, the $\bar{\omega}_w \cos \beta_{TE}/2\sigma$ definition of a wake total-loss parameter, will be used in all subsequent figures and discussion.

Effect of weight flow on radial distribution of loss. - In figure 20 the $\bar{\omega}_w$ at high flow (near choke) and at low flow (near stall) operation are compared with those near peak stage efficiency (from fig. 19). Near-choke operation of S9D resulted in a sharp rise in losses over the inner half span, with the loss levels much higher than those for

S9 and S9C. This is attributed to the much smaller design choke margins in this region for S9D (fig. 4(i)).

In contrast, near-stall operation of S9 and S9C showed highest losses over the outer half-span and at levels above those for S9D. Here, design incidence angles and multiple-circular-arc inlet-segment turning rates (ref. 15) are higher for S9 and S9C than for S9D. Both of these variables led to higher peak velocities on the suction surface, and thus higher losses should be expected.

In summary, at high-flow operation, loss levels appeared sensitive to design choke margins, with greatest losses where margins were smallest. At low flow operation, loss levels were sensitive to design incidence angles and inlet-segment turning rates, with lowest losses when they were lowest.

Effect of diffusion factor and spanwise location on loss. - The total-loss parameter as a function of D-factor over the complete range of throttle settings tested is shown in figure 21. In figure 22 only minimum loss values are plotted. Compared with 100 percent of design speed data, the 70 percent of design speed data in figure 21 show an extension of the low loss range to lower D-factors. The decreasing D-factors and decreasing loss reflect decreasing incidence angles due to increased weight flow from throttle opening. If flow is increased enough, an eventual increase in blade-element loss usually occurs because of a more adverse pressure-surface velocity gradient. This gradient would be most severe if the elemental flow passage was choked. Flow area margins from choke, designed for the 100-percent speed are, of course, larger for the 70-percent speed inlet conditions. Thus, it is not surprising that the lower speed extends the low-loss range toward the higher flows (lower D factors). For S9C there is no difference in the loss curve due to speed in the low D-factor range. The generally higher design choke margins for S9C, compared with S9 or S9D (see fig. 4(i)), are believed responsible for this result.

The minimum loss values (fig. 22) in the 30- to 70-percent span region are in good agreement with a previous correlation for double-circular-arc and NACA $65-(A_{10})$-series blades. The present data extend it to the multiple-circular-arc blades studied. For them, in the midspan region Mach number reached about 0.83, and blade solidities ranged from 1.6 to 2.1.

In both end-wall regions (10- and 90-percent span) the minimum losses (fig. 22) at a given D-factor tend to be lower for the short-chord S9 and S9R than for the moderate-chord S9C and S9D. Perhaps the secondary flows or corner vortices are stronger with the longer chord because of the longer time to develop. Stage reaction and level of stator D-factor may also influence this end-wall loss comparison with stator chord. Design values of stage reaction are about 75 percent for the stages studied, along with stator D-factors of about 0.4 near the tip and 0.5 near the hub.

In summary, the effect of diffusion factor on minimum loss levels in the midspan region (30- to 70-percent span) follows the correlation of NASA SP-36 (ref. 21). In both end-wall regions (10- and 90-percent span) the minimum losses at a given D-factor tend to be lowest for the short-chord design (S9).

Effect of air turning on loss. - In figure 23 the total-loss parameter at design speed is shown as a function of air turning for 30-, 50-, and 70-percent span. Incidence and deviation angles are also listed alongside selected data points. (The short-chord data are plotted separately simply to avoid confusion of symbols.) The purpose of figure 23 is to show that the total-pressure losses involved in a given air turning can be minimized by using more blade camber and less incidence angle. For example, at 50-percent span and an air turning near 31°, both S9C and S9 are operating near their minimum loss levels, but the loss is less for S9C. The S9C data point has a 10° lower incidence angle than S9 but about a 7.2° greater camber (tables VII and V). The remaining difference in turning is mainly due to 2° less deviation angle for S9C. Similar midspan comparisons can be made between S9C and S9D at about 36°, but there, S9C is not quite at minimum loss operation.

Thus, in the midspan region and for design speed, air turning was more efficiently done with blade camber than with incidence angle.

Incidence and deviation angle, loss, and loading relations across the span. - These parameters for each stator at five spanwise locations and design speed are summarized in figure 24. The range of inlet Mach numbers are also listed. In the midspan region and for minimum-loss operation, the higher incidence angles for S9 and S9R are primarily responsible for their higher loss levels. These higher incidence angles are a consequence of the original design considerations, both aerodynamic and fabrication, as previously discussed. The higher losses stem from higher suction-surface velocity peaks with higher incidence angle as shown and discussed in Part II (ref. 11).

As previously discussed herein, the losses in both end-wall regions (figs. 24(a) and (e)) are generally less for the short-chord stator than for the moderate-chord ones for all incidence angles tested.

Deviation angles are shown to be generally insensitive to incidence angle except near wide-open throttle operation. In the midspan region deviation angles are higher for S9D than for S9C, but both are reasonably well predicted by the modified Carter's rule that was used (see ref. 15). The higher setting angle for S9D, compared with S9C, results in a shorter, covered (or controlled) passage. Location of maximum camber is also further aft on S9D, which requires more air turning to be done in the aft portion of the blade. These two design features for S9D compared with S9C account for most of the deviation angle differences measured.

Midspan deviation angles for S9 or S9R are not as well predicted. Perhaps their short chord or unusually high incidence angles, or both, are too much for a deviation angle rule that ignores both features.

In both end-wall regions the deviation angles were 3° to 5° higher than predicted for all stators studied. Some three-dimensional corrections to a two-dimensional deviation rule are obviously needed.

As the hub region is approached, both D-factor (blade loading) and inlet Mach number are increasing. Thus, it is the most critical flow region in the overall stator design. Near the hub (fig. 24(e)) the maximum blade loading expressed as D-factor does not exceed a level of about 0.5. A subsequent section discusses and correlates these near-stall loading levels.

To summarize, the relatively high design incidence angles for S9 caused relatively high loss levels in the midspan region. However, in both end-wall regions, the shorter chord S9 had the lowest losses. Midspan deviation angles are reasonably well predicted for the moderate-chord S9C and S9D designs, and near the end walls a three-dimensional correction is needed for all designs tested.

Effect of Mach number and stator design on minimum-loss incidence and deviation angles. - At minimum-loss operation and at midspan, the incidence angles $(i_{mc})_{ref}$ and deviation angles δ^o_{ref}, relative to the two-dimensional, low-speed, cascade rule values (from ref. 21), are shown as functions of inlet Mach number in figure 25. If minimum loss extended over a range of incidence angles, the midpoint was chosen for $(i_{mc})_{ref}$. If a minimum loss was not indicated by the data, $(i_{mc})_{ref}$ was taken as that angle at the lowest measured loss condition. The Mach number variations came from data at 70, 90, and 100 percent of design speed. The δ^o_{ref} values are those that accompany the $(i_{mc})_{ref}$ values.

The incidence-angle correction for compressibility for S9D varies from about -2° to +1½° as Mach number increases from 0.55 to 0.77. Over the lower half of this range there is close agreement with the data of NASA SP-36 (ref. 21), which end at about Mach 0.65. Incidence corrections for S9 and S9C show similar trends as Mach number increases, but there are level shifts of unknown cause. Along a particular streamline and for a fixed incidence angle, higher inlet Mach numbers reduce the margin from choking the blade-to-blade passage. The higher incidence angles for minimum loss are believed required to open up the flow passage and avoid the high losses associated with choking.

The effect of increasing Mach number on the compressibility correction for deviation angle (fig. 25(b)) was smaller than that for incidence angle for all designs tested. For S9D the correction is constant, extending the same trend shown by the NASA SP-36 data but at a 2° to 3° higher level. The location of maximum camber is aft of 50-percent chord for S9D. This increases its deviation angle relative to a circular-arc blade according to the design rule used for S9D (ref. 15). This may account for the level shift shown.

In summary, the compressibility correction for minimum-loss incidence angle for S9D is smallest of all designs studied, and follows past experience for circular-arc stators. Deviation angles at minimum loss showed little variation with inlet Mach number especially for S9D, but its level was a few degrees higher than circular arc experience.

Effect of loading on stage stall. - The combination of high inlet Mach number and high diffusion factor D, at either the rotor tip or the stator hub generally makes one or the other (or both) region the critical one that initiates stage stall. As shown in reference 4 and based in part on rotor-alone tests, the stator-hub region initiated stage stall for stage 15-9 or 15-9R at 90 and 100 percent of design speed. At lower speeds the stator hub or rotor tip, or both, may have been critical, that is, stalled first. Following the approach of reference 4, blade-element D-factors over the entire flow range and for the four different stator-hub (90-percent span from tip) sections are shown in figure 26. (Parts (a) and (b) of fig. 26 are from ref. 4.) As discussed there, a small but consistent effect of measuring station (2a or 2b) on the value of diffusion factor was evident and is shown on figures 26(a) and (b).

Generally, the stator-hub diffusion factor increases as flow is reduced until a maximum level is reached at the near-stall flow that is nearly the same for all speeds tested with a particular stator. Also, the rotor-alone stall flows indicated were never greater than the stage values. This implies the stator hub elements were near stall when the stage was near stall for all speeds tested. The critical D-factor for S9D (fig. 26(d)) is about 0.46, midway between that shown for S9 (0.445) and S9R (0.485), all with the same interblade row measuring station 2b. Likewise the critical D-factor for S9C (fig. 26(c)) is about 0.485 which is midway between the 0.47 and 0.51 for S9 and S9R, respectively, with measuring station 2a.

As was the case with S9 and S9R (ref. 4), small, but systematic effects of axial velocity ratio on critical loading levels were evident for S9C and S9D as shown in figure 27. As axial velocity ratio across any of the stators increased, the critical D-factor decreased linearly. Reasons for the apparent dependence of stator critical D-factor on axial velocity are not presently known. However, this relation can be used to define a modified loading parameter, the value of which is constant for the four stator configurations at their respective critical-hub-element, near-stall-operating conditions at 90 and 100 percent of design speed. This is demonstrated next.

A modified, near-stall loading parameter, $D + 0.64 (V_{z3}/V_{z2})$, at 90-percent span from the tip is shown to be invariant with flow, speed, or stator configuration in figure 28. The small but consistent effect of interblade row measuring station (2a or 2b) distinguishes part (a) from part (b) in the figure. As indicated, a single value for stator critical modified loading parameter of 1.13 (based on stations 2a and 3) or the corresponding 1.09 (based on stations 2b and 3) applies for all configurations at both 90 and 100 percent of design speed.

For close axial coupling of rotor and stator, this critical D-factor correlation may not apply. The different hub contouring required, or the unknown effects of less well-mixed flow from the rotor, could affect these results. However, when stators S9 and S9R were tested, at 1.0- and 1.5-rotor chord spacings instead of 3.5, the stall critical levels of loading were unchanged (ref. 4).

Typical stator design practice uses an axial velocity ratio of about 1.0, which decreases only a few percent at near-stall operation. With the stator critical modified loading parameter equal to 1.13 (station 2a) or 1.09 (station 2b), a critical D-factor of about 0.49 (station 2a) or 0.45 (station 2b) is indicated. These levels of D-factor compare unfavorably with those from reference 22 where two different stator designs were tested with a 305-meter-per-second rotor. There, stator-hub-element (90-percent span from tip) critical D-factors were about 0.6 for both designs. One of these designs was used as a pattern for S9D. Different facilities, model sizes, and data-reduction techniques are involved which have not been fully evaluated. Perhaps the oncoming wall boundary layer is sufficiently different to account for the different critical loading levels. The real reasons for this remain unknown.

In summary, the stator-hub region initiated stage stall for all designs tested at 100 percent of design speed. Near stall, the stator-hub-element (90-percent span from tip) D-factors were about 0.47 and essentially the same for all designs.

SUMMARY OF RESULTS

The aerodynamic performances of four stator-blade rows, each operated downstream of the same rotor, have been presented and evaluated. The rotor and flow path were a 0.5-meter-diameter model of the NASA QF-1 fan (tip speed, 337 m/sec; pressure ratio, 1.54). The aerodynamic designs of two of these stator rows were compromised to reduce noise, a third design was not. The original stator for NASA QF-1, called S9, had a short chord because of the large number of blades required to achieve low noise. It also had relatively thick blades to allow casting. A second configuration, called S9R, was simply S9 reset 3.7° closed. The two other designs, called S9C and S9D had twice the chord of S9, about half the blade number and were thinner. The radial distribution of incidence angle for S9C was skewed to satisfy a low-noise theory of minimum lift fluctuations. The S9D had no noise constraints but was patterned after a NASA-sponsored design that had demonstrated the best known performance at high inlet Mach numbers. The following principal results were obtained:

1. Overall performance at design speed on a calculated operating line passing through the design point pressure ratio was

Stage designation	Stage total-pressure ratio	Stage temperature-rise efficiency	Stage stall margin, percent	Pressure-ratio decrement across stator[a]	Efficiency decrement across stator[a]
Rotor 15 - stator 9	1.475	0.835	4	0.033	0.057
Rotor 15 - stator 9R	1.482	.845	[b]11	.031	.045
Rotor 15 - stator 9C	1.475	.830	[b]8	[c].038	[c].056
Rotor 15 - stator 9D	1.485	.865	[b]12	.031	.044
Design values	1.50	.85	---	.042	.060

[a] Based on measuring stations 2b and 3 (fig. 1).

[b] Stall margins greater than about 4 percent were dependent on a positive-slope pressure-flow characteristic at design speed caused by high rotor losses. These higher stall margins are not considered usable in a practical application (see ref. 4).

[c] Includes estimated difference between stations 2a and 2b.

The best performing stator was S9D with overall pressure-ratio and efficiency decrements of 0.031 and 0.044, respectively. The shorter chord S9R exhibited similar values but left some swirl in the exit flow due to 3.7° of reset. Without reset, S9 had pressure ratio and efficiency decrements of 0.033 and 0.057.

2. In the end-wall regions, the blade-element losses were significantly less for the short-chord (1.85 cm) S9 and S9R than for the moderate-chord (3.72 cm) S9C and S9D at all design-speed operating conditions.

3. In the midspan region and for design speed, air turning was more efficiently done with blade camber than with incidence angle.

4. Flow in the stator-hub region initiated stage stall for all designs tested at design speed. Near stall, the hub-element (90-percent span from tip-diffusion factors were about 0.47 and essentially the same for all designs.

Lewis Research Center,
National Aeronautics and Space Administration,
Cleveland, Ohio, October 1, 1979,
505-04.

APPENDIX A

SYMBOLS

A/A^*	flow area to critical area ratio
ΔA_{an}	incremental annulus area, m^2
A_{an}	annulus area at rotor leading edge, m^2
A_f	frontal area at rotor leading edge, m^2
C	change in blade angle per unit path distance, (dK/dS), deg/cm
C_p	specific heat at constant pressure, 1004 J/kg K
c	aerodynamic chord, cm
D	diffusion factor
i_{mc}	mean incidence angle, angle between inlet air direction and line tangent to blade mean camber line at leading edge, deg
i_{ss}	suction-surface incidence angle, angle between inlet air direction and line tangent to blade suction surface at leading edge, deg
K	local blade angle with respect to meridional direction, deg
M	Mach number
N	rotative speed, rpm
NR	number of radial locations where measurements of flow conditions are made
N_D	design rotative speed, 13 020 rpm
n	coordinate in tangential direction, cm
P	total pressure, N/cm^2
p	static pressure, N/cm^2
r	radius, cm
S	path distance on blade-element layout cone, cm
SM	stall margin
T	total temperature, K
U	wheel speed, m/sec
V	velocity, m/sec
W	weight flow, kg/sec

W_D	design weight flow, 29.16 kg/sec
Z	axial distance from rotor-blade-hub leading edge, cm
α_c	cone angle, deg
α_s	slope of streamline, deg
β	air angle, angle between air velocity and axial direction, deg
β'_c	relative meridional flow angle based on cone angle, arctan $(\tan \beta'_m \cos \alpha_c \cos \alpha_s)$, deg
γ	ratio of specific heats (1.40)
δ	ratio of rotor-inlet total pressure to standard pressure of 10.13 N/cm^2
δ^o	deviation angle, angle between exit-air direction and tangent-to-blade mean camber line at trailing edge, deg
η	efficiency
θ	ratio of rotor-inlet total temperature to standard temperature of 288.2 K
κ_{mc}	angle between blade mean camber line and meridional plane, deg
κ_{ss}	angle between blade suction-surface camber line at leading edge and meridional plane, deg
ρ	density, kg/m^3
σ	solidity, ratio of chord to spacing
φ	blade camber, deg
$\bar{\omega}$	total-loss coefficient
$\bar{\omega}_p$	profile-loss coefficient
$\bar{\omega}_s$	shock-loss coefficient
$\bar{\omega}_w$	wake total-loss coefficient where $(P'_{id})_{TE}$ (see eq. (B9)), is average of three highest values measured across the stator gap

Subscripts:

a	aft blade segment
ad	adiabatic
c	blade-element centerline on layout cone
f	front
h	hub

id	ideal
LE	blade leading edge
m	meridional direction
mom	momentum rise
p	polytropic
ref	reference or value at minimum loss operation (fig. 25)
TE	blade trailing edge
t	transition point (from inlet to outlet segment camber)
th	throat
tip	tip
z	axial direction
θ	tangential direction
1	instrumentation plane upstream of rotor
2a, 2b, 2b'	instrumentation planes between rotor and stator (see fig. 1)
2D	two-dimensional values (fig. 25)
3	instrumentation plane downstream of stator
Superscript:	
'	relative to blade

APPENDIX B

EQUATIONS

Mean incidence angle -

$$i_{mc} = \left(\beta'_c\right)_{LE} - \left(\kappa_{mc}\right)_{LE} \tag{B1}$$

Suction-surface incidence angle -

$$i_{ss} = \left(\beta'_c\right)_{LE} - \left(\kappa_{ss}\right)_{LE} \tag{B2}$$

Deviation angle -

$$\delta^o = \left(\beta'_c\right)_{TE} - \left(\kappa_{mc}\right)_{TE} \tag{B3}$$

Front suction-surface camber -

$$\varphi_{f,ss} = \left(\kappa_{ss}\right)_{LE} - \left(\kappa_{ss}\right)_t \tag{B4}$$

Total camber -

$$\varphi_t = \left(\kappa_{mc}\right)_{LE} - \left(\kappa_{mc}\right)_{TE} \tag{B5}$$

Turn rate ratio -

$$(C_f/C_a) \tag{B6}$$

Choke margin -

$$(A/A^* - 1.0)_{minimum} \tag{B7}$$

Diffusion factor -

$$D = 1 - \frac{V'_{TE}}{V'_{LE}} + \left| \frac{\left(rV_\theta\right)_{TE} - \left(rV_\theta\right)_{LE}}{(r_{TE} + r_{LE})\sigma(V'_{LE})} \right| \tag{B8}$$

Total-loss coefficient -

$$\bar{\omega} = \frac{\left(P'_{id}\right)_{TE} - \overline{P'_{TE}}}{P'_{LE} - p_{LE}} \tag{B9}$$

Profile-loss coefficient -

$$\bar{\omega}_p = \bar{\omega} - \bar{\omega}_s \tag{B10}$$

Total-loss parameter -

$$\frac{\bar{\omega} \cos\left(\beta'_c\right)_{TE}}{2\sigma} \tag{B11}$$

Profile-loss parameter -

$$\frac{\bar{\omega}_p \cos\left(\beta'_c\right)_{TE}}{2\sigma} \tag{B12}$$

Rotor total-pressure ratio -

$$\left(\overline{P_2/P_1}\right) = \left[\frac{\int_{r_h}^{r_t} (P_2/P_1)^{(\gamma-1)/\gamma} \rho v_z \, r \, dr}{\int_{r_h}^{r_t} \rho v_z \, r \, dr}\right]^{\gamma/(\gamma-1)}$$

$$= \left[\frac{\sum_{i=1}^{NR} \left(P_2/P_1\right)_i^{(\gamma-1)/\gamma} \rho_{2,i} V_{z2,i} \Delta A_{an,2,i}}{\sum_{i=1}^{NR} \rho_{2,i} V_{z2,i} \Delta A_{an,2,i}}\right]^{\gamma/(\gamma-1)} \tag{B13}$$

Stage total-pressure ratio -

$$\left(\overline{P_3/P_1}\right) = \left[\frac{\int_{r_h}^{r_t} (P_3/P_1)^{(\gamma-1)/\gamma} \rho v_z \; r \, dr}{\int_{r_h}^{r_t} \rho v_z \; r \, dr}\right]^{\gamma/(\gamma-1)}$$

$$= \left[\frac{\sum_{i=1}^{NR} \left(P_3/P_1\right)_i^{(\gamma-1)/\gamma} \rho_{3,i} \, V_{z3,i} \, \Delta A_{an,3,i}}{\sum_{i=1}^{NR} \rho_{3,i} \, V_{z3,i} \, \Delta A_{an,3,i}}\right]^{\gamma/(\gamma-1)} \tag{B14}$$

Total-temperature ratio -

$$\left(\overline{T_2/T_1}\right) = \frac{\int_{r_h}^{r_t} (T_2/T_1) \, \rho v_z \; r \, dr}{\int_{r_n}^{r_t} \rho v_z \; r \, dr} = \frac{\sum_{i=1}^{NR} \left(T_2/T_1\right)_i \rho_{2,i} \, V_{z2,i} \, \Delta A_{an,2,i}}{\sum_{i=1}^{NR} \rho_{2,i} \, V_{z2,i} \, \Delta A_{an,2,i}} \tag{B15}$$

Rotor adiabatic efficiency -

$$\eta_{ad} = \frac{\left(\overline{P_2/P_1}\right)^{(\gamma-1)/\gamma} - 1}{\left(\overline{T_2/T_1}\right) - 1} \tag{B16}$$

Stage adiabatic efficiency -

$$\eta_{ad} = \frac{\left(\overline{P_3/P_1}\right)^{(\gamma-1)/\gamma} - 1}{\left(\overline{T_3/T_1}\right) - 1} \tag{B17}$$

Rotor-inlet mass averaged temperature -

$$\overline{T}_1 = \frac{\displaystyle\int_{r_h}^{r_t} T_1 \rho v_z \, r \, dr}{\displaystyle\int_{r_h}^{r_t} \rho v_z \, r \, dr} = \frac{\displaystyle\sum_{i=1}^{NR} T_{1,i} \rho_{1,i} V_{z1,i} \Delta A_{an,1,i}}{\displaystyle\sum_{i=1}^{NR} \rho_{1,i} V_{z1,i} \Delta A_{an,1,i}} \tag{B18}$$

Momentum-rise efficiency -

$$\eta_{mom} = \frac{\left(\overline{P_2/P_1}\right)^{(\gamma-1)/\gamma} - 1}{\dfrac{\displaystyle\int_{r_n}^{r_t} \left[\left(UV_\theta\right)_2 - \left(UV_\theta\right)_1\right] \rho v_z \, r \, dr}{\overline{T}_1 C_p}}$$

$$= \frac{\left(\overline{P_2/P_1}\right)^{(\gamma-1)/\gamma} - 1}{\dfrac{\displaystyle\sum_{i=1}^{NR} \left[\left(UV_\theta\right)_2 - \left(UV_\theta\right)_1\right] \rho_{2,i} V_{z2,i} \Delta A_{2,i}}{\overline{T}_1 C_p}} \tag{B19}$$

Head-rise coefficient -

$$\frac{C_p \overline{T}_1}{U_{tip}^2} \left[\left(\overline{P_2/P_1}\right)^{(\gamma-1)/\gamma} - 1\right] \tag{B20}$$

Equivalent mass flow -

$$\frac{W\sqrt{\theta}}{\delta} \tag{B21}$$

Equivalent speed -

$$\frac{N}{\sqrt{\theta}} \tag{B22}$$

Mass flow per unit annulus area -

$$\frac{\dfrac{W\sqrt{\theta}}{\delta}}{A_{an}} \tag{B23}$$

Mass flow per unit frontal area -

$$\frac{\dfrac{W\sqrt{\theta}}{\delta}}{A_{f}} \tag{B24}$$

Flow coefficient -

$$\left(\frac{V_z}{U_t}\right)_{LE} \tag{B25}$$

Stall margin -

$$SM = \left[\frac{\left(\overline{P_3/P_1}\right)_{stall}\left(\dfrac{W\sqrt{\theta}}{\delta}\right)_{ref}}{\left(\overline{P_3/P_1}\right)_{ref}\left(\dfrac{W\sqrt{\theta}}{\delta}\right)_{stall}} - 1\right] \times 100 \tag{B26}$$

Rotor polytropic efficiency -

$$\eta_p = \frac{\ln\left(\overline{P_2/P_1}\right)^{(\gamma-1)/\gamma}}{\ln\left(\overline{T_2/T_1}\right)} \tag{B27}$$

Stage polytropic efficiency -

$$\eta_p = \frac{\ln\left(\overline{P_3/P_1}\right)^{(\gamma-1)/\gamma}}{\ln\left(\overline{T_3/T_1}\right)} \tag{B28}$$

APPENDIX C

ABBREVIATIONS AND UNITS USED IN TABLES

ABS	absolute
AERO CHORD	aerodynamic chord, cm
AREA RATIO	ratio of actual flow area to critical area (where local Mach number is 1)
BETAM	meridional air angle, deg
CONE ANGLE	angle between axial direction and conical surface representing blade element, deg
DELTA INC	difference between mean camber blade angle and suction-surface blade angle at leading edge, deg
DEV	deviation angle (defined by eq. (B3)), deg
D-FACT	diffusion factor (defined by eq. (B8))
EFF	adiabatic efficiency (defined by eq. (B16) or (B17))
IN	inlet (leading edge of blade)
INCIDENCE	incidence angle (suction surface defined by eq. (B2), and mean by eq. (B1)), deg
KIC	angle between blade mean camber line at leading edge and meridional plane, deg
KOC	angle between blade mean camber line at trailing edge and meridional plane, deg
KTC	angle between blade mean camber line at transition point and meridional plane, deg
LOSS COEFF	loss coefficient (total defined by eq. (B9), profile by eq. (B10))
LOSS PARAM	loss parameter (total defined by eq. (B11), profile by eq. (B12))
MERID	meridional
MERID VEL R	meridional velocity ratio
OUT	outlet (trailing edge of blade)
PERCENT SPAN	percent of blade span from tip at rotor trailing edge for design streamlines

PHISS	suction-surface camber ahead of assumed shock location, deg
PRESS	pressure, N/cm^2
PROF	profile
RADII	radius, cm
REL	relative to blade
RI	inlet radius (leading edge of blade), cm
RO	outlet radius (trailing edge of blade), cm
RP	radial position
RPM	equivalent rotative speed, rpm
SETTING ANGLE	angle between aerodynamic chord and meridional plane, deg
SOLIDITY	ratio of aerodynamic chord to blade spacing
SPEED	speed, m/sec
SS	suction surface
STREAMLINE SLOPE	slope of streamline, deg
TANG	tangential
TEMP	temperature, K
TI	thickness of blade at leading edge, cm
TM	thickness of blade at maximum thickness, cm
TO	thickness of blade at trailing edge, cm
TOT	total
TOTAL CAMBER	difference between inlet and outlet blade mean camber lines, deg
TURN RATE	ratio of inlet-segment turning rate to outlet segment turning rate for a blade element
VEL	velocity, m/sec
WT FLOW	equivalent weight flow, kg/sec
X FACTOR	ratio of suction-surface camber ahead of assumed shock location of a multiple-circular-arc blade section to that of a double-circular-arc blade section
ZIC	axial distance to blade leading edge from rotor-hub leading edge, cm

ZMC	axial distance to blade maximum thickness point from rotor-hub leading edge, cm
ZOC	axial distance to blade trailing edge from rotor-hub leading edge, cm
ZTC	axial distance to transition point from rotor-hub leading edge, cm

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TABLE I. - DESIGN OVERALL PARAMETERS

FOR STAGE 15-9

ROTOR TOTAL PRESSURE RATIO	1.541
STAGE TOTAL PRESSURE RATIO	1.499
ROTOR TOTAL TEMPERATURE RATIO	1.145
STAGE TOTAL TEMPERATURE RATIO	1.145
ROTOR ADIABATIC EFFICIENCY	0.909
STAGE ADIABATIC EFFICIENCY	0.848
ROTOR POLYTROPIC EFFICIENCY	0.915
STAGE POLYTROPIC EFFICIENCY	0.856
ROTOR HEAD RISE COEFFICIENT	0.334
STAGE HEAD RISE COEFFICIENT	0.312
FLOW COEFFICIENT	0.581
WT FLOW PER UNIT FRONTAL AREA	151.534
WT FLOW PER UNIT ANNULUS AREA	201.797
WT FLOW	29.161
RPM	13020.000
TIP SPEED	337.451

TABLE II. - DESIGN BLADE-ELEMENT PARAMETERS FOR ROTOR 15

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
TIP	24.750	23.962	0.	40.8	63.6	45.6	288.2	1.169	10.13	1.541
1	24.132	23.424	0.	38.9	61.6	44.9	288.2	1.158	10.13	1.541
2	23.510	22.886	-0.	37.6	59.8	44.1	288.2	1.149	10.13	1.541
3	22.884	22.347	-0.	36.9	58.3	43.0	288.2	1.143	10.13	1.541
4	21.021	20.732	-0.	38.2	54.7	37.6	288.2	1.139	10.13	1.541
5	18.560	18.579	-0.	41.5	50.9	27.1	288.2	1.141	10.13	1.541
6	16.075	16.425	-0.	45.3	47.2	11.7	288.2	1.144	10.13	1.541
7	14.192	14.810	-0.	48.6	44.0	-3.0	288.2	1.148	10.13	1.541
8	13.573	14.272	-0.	49.9	42.7	-8.3	288.2	1.149	10.13	1.541
9	12.960	13.734	-0.	51.3	41.5	-13.8	288.2	1.151	10.13	1.541
HUB	12.352	13.195	0.	52.6	40.1	-19.2	288.2	1.152	10.13	1.541

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
TIP	167.3	229.2	376.6	247.7	167.3	173.4	0.	149.8	337.5	326.7
1	177.8	227.4	374.0	249.9	177.8	176.9	0.	142.9	329.0	319.4
2	186.3	226.5	370.7	249.8	186.3	179.4	-0.	138.2	320.5	312.0
3	192.7	226.3	366.7	247.4	192.7	180.9	-0.	135.9	312.0	304.7
4	203.0	230.9	351.2	229.1	203.0	181.5	-0.	142.7	286.6	282.7
5	205.7	242.4	326.1	203.9	205.7	181.6	-0.	160.6	253.1	253.3
6	203.2	261.7	298.9	188.0	203.2	184.2	-0.	185.9	219.2	224.0
7	200.7	282.0	278.8	186.6	200.7	186.3	-0.	211.7	193.5	201.9
8	200.2	290.1	272.7	188.7	200.2	186.8	-0.	221.9	185.1	194.6
9	200.0	298.8	266.9	192.5	200.0	187.0	-0.	233.1	176.7	187.3
HUB	200.1	308.3	261.5	198.1	200.1	187.1	0.	245.0	168.4	179.9

	ABS MACH NO		REL MACH NO		MERID MACH NO		STREAMLINE SLOPE		MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
TIP	0.504	0.649	1.135	0.701	0.504	0.491	-19.40	-14.51	1.037	1.448
1	0.537	0.646	1.130	0.710	0.537	0.503	-16.77	-12.48	0.995	1.455
2	0.565	0.646	1.124	0.713	0.565	0.512	-14.29	-10.63	0.963	1.455
3	0.585	0.648	1.114	0.708	0.585	0.518	-11.97	-8.97	0.939	1.448
4	0.619	0.663	1.071	0.658	0.619	0.521	-5.98	-4.78	0.894	1.451
5	0.628	0.699	0.995	0.588	0.628	0.523	0.30	-0.20	0.883	1.475
6	0.620	0.759	0.911	0.546	0.620	0.534	5.93	4.15	0.906	1.405
7	0.611	0.825	0.849	0.546	0.611	0.545	10.16	7.57	0.928	1.324
8	0.610	0.851	0.831	0.554	0.610	0.548	11.61	8.79	0.933	1.292
9	0.609	0.880	0.813	0.567	0.609	0.551	13.07	10.05	0.935	1.258
HUB	0.609	0.911	0.797	0.586	0.609	0.553	14.55	11.34	0.935	1.222

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
TIP	0.	3.3	-0.0	7.0	0.488	0.778	0.189	0.154	0.049	0.040
1	5.00	3.4	-0.0	6.4	0.469	0.834	0.136	0.100	0.035	0.026
2	10.00	3.5	0.0	5.9	0.458	0.883	0.093	0.059	0.024	0.015
3	15.00	3.6	-0.0	5.7	0.453	0.919	0.063	0.031	0.016	0.008
4	30.00	4.2	-0.0	5.8	0.479	0.944	0.046	0.018	0.012	0.005
5	50.00	5.5	0.0	6.4	0.517	0.936	0.058	0.035	0.015	0.009
6	70.00	7.8	-0.0	7.4	0.529	0.914	0.090	0.081	0.022	0.020
7	85.00	10.3	0.0	8.1	0.504	0.890	0.131	0.129	0.029	0.029
8	90.00	11.6	0.0	8.2	0.486	0.882	0.148	0.147	0.031	0.031
9	95.00	13.1	0.0	8.3	0.462	0.873	0.166	0.165	0.033	0.033
HUB	100.00	14.9	-0.0	8.5	0.430	0.864	0.185	0.185	0.034	0.034

TABLE III. - BLADE GEOMETRY FOR ROTOR 15

	PERCENT	RADII		BLADE ANGLES			DELTA	CONE
RP	SPAN	RI	RO	KIC	KTC	KOC	INC	ANGLE
TIP	0.	24.750	23.962	60.18	56.04	37.62	3.32	-20.375
1	5.	24.132	23.424	58.16	53.63	37.89	3.37	-17.428
2	10.	23.510	22.886	56.33	51.57	37.68	3.46	-14.752
3	15.	22.884	22.347	54.69	49.88	37.00	3.58	-12.262
4	30.	21.021	20.732	50.52	45.02	31.80	4.17	-5.998
5	50.	18.560	18.579	45.41	38.87	20.63	5.49	0.349
6	70.	16.075	16.425	39.39	32.45	4.28	7.78	5.833
7	85.	14.192	14.810	33.67	27.61	-11.12	10.32	9.632
8	90.	13.573	14.272	31.22	26.10	-16.53	11.60	10.738
9	95.	12.960	13.734	28.47	24.63	-22.01	13.13	11.756
HUB	100.	12.352	13.195	25.42	23.22	-27.59	14.88	12.727

	BLADE THICKNESSES			AXIAL DIMENSIONS			
RP	TI	TM	TO	ZIC	ZMC	ZTC	ZOC
TIP	0.036	0.143	0.032	0.711	1.655	1.926	2.831
1	0.036	0.145	0.031	0.666	1.683	1.914	2.920
2	0.037	0.147	0.032	0.620	1.700	1.886	2.990
3	0.038	0.151	0.032	0.573	1.706	1.841	3.042
4	0.042	0.167	0.034	0.448	1.673	1.674	3.196
5	0.050	0.199	0.038	0.313	1.624	1.408	3.407
6	0.062	0.246	0.045	0.203	1.625	1.114	3.638
7	0.074	0.295	0.052	0.082	1.631	0.825	3.723
8	0.079	0.315	0.055	0.048	1.637	0.731	3.734
9	0.084	0.337	0.058	0.022	1.648	0.641	3.738
HUB	0.090	0.360	0.061	0.000	1.664	0.554	3.734

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	X FACTOR	PHISS	AREA RATIO
TIP	3.880	53.99	22.56	1.344	0.500	8.34	1.005
1	3.863	51.91	20.27	1.370	0.578	8.62	1.014
2	3.851	50.05	18.65	1.400	0.638	8.76	1.021
3	3.838	48.36	17.69	1.431	0.681	8.78	1.024
4	3.812	42.94	18.72	1.540	0.780	9.66	1.036
5	3.802	34.59	24.78	1.727	0.858	11.38	1.046
6	3.820	23.56	35.11	1.983	0.920	13.11	1.047
7	3.858	13.29	44.80	2.244	0.963	13.64	1.029
8	3.871	9.62	47.75	2.346	0.976	13.54	1.015
9	3.887	5.85	50.48	2.456	0.989	13.30	0.996
HUB	3.906	1.98	53.02	2.579	1.000	12.92	0.972

TABLE IV. - DESIGN BLADE-ELEMENT PARAMETERS FOR STATOR 9

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
TIP	23.414	23.409	37.5	0.	37.5	0.	336.9	1.000	15.61	0.952
1	22.948	22.945	35.3	0.	35.3	0.	333.6	1.000	15.61	0.961
2	22.478	22.475	33.8	-0.	33.8	-0.	331.1	1.000	15.61	0.969
3	22.004	21.999	32.9	-0.	32.9	-0.	329.4	1.000	15.61	0.975
4	20.577	20.575	33.4	-0.	33.4	-0.	328.3	1.000	15.61	0.983
5	18.682	18.718	36.1	-0.	36.1	-0.	328.7	1.000	15.61	0.986
6	16.786	16.916	40.2	-0.	40.2	-0.	329.6	1.000	15.61	0.983
7	15.343	15.622	45.4	-0.	45.4	-0.	330.7	1.000	15.61	0.979
8	14.848	15.165	47.2	-0.	47.2	-0.	331.1	1.000	15.61	0.951
9	14.344	14.683	49.0	-0.	49.0	-0.	331.6	1.000	15.61	0.899
HUB	13.833	14.181	50.8	-0.	50.8	-0.	332.0	1.000	15.61	0.821

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
TIP	252.0	187.1	252.0	187.1	199.9	187.1	153.4	0.	0.	0.
1	252.2	190.9	252.2	190.9	205.7	190.9	145.9	0.	0.	0.
2	253.0	193.8	253.0	193.8	210.3	193.8	140.7	-0.	0.	0.
3	254.3	195.9	254.3	195.9	213.6	195.9	138.0	-0.	0.	0.
4	261.2	198.7	261.2	198.7	218.1	198.7	143.8	-0.	0.	0.
5	271.2	199.1	271.2	199.1	219.2	199.1	159.7	-0.	0.	0.
6	281.8	198.5	281.8	198.5	215.1	198.5	181.9	-0.	0.	0.
7	287.2	195.2	287.2	195.2	201.8	195.2	204.4	-0.	0.	0.
8	289.9	188.7	289.9	188.7	196.9	188.7	212.7	-0.	0.	0.
9	293.5	177.7	293.5	177.7	192.5	177.7	221.5	-0.	0.	0.
HUB	297.8	162.0	297.8	162.0	188.3	162.0	230.7	-0.	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		STREAMLINE SLOPE		MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
TIP	0.719	0.522	0.719	0.522	0.571	0.522	-0.01	0.00	0.936	1.261
1	0.724	0.536	0.724	0.536	0.591	0.536	0.01	0.01	0.928	1.212
2	0.730	0.547	0.730	0.547	0.606	0.547	0.02	0.01	0.922	1.181
3	0.736	0.555	0.736	0.555	0.618	0.555	0.03	0.00	0.917	1.165
4	0.760	0.564	0.760	0.564	0.634	0.564	0.27	0.18	0.911	1.196
5	0.792	0.565	0.792	0.565	0.640	0.565	1.39	1.25	0.908	1.274
6	0.825	0.563	0.825	0.563	0.630	0.563	3.69	3.59	0.923	1.377
7	0.842	0.551	0.842	0.551	0.592	0.551	6.87	7.40	0.967	1.469
8	0.850	0.532	0.850	0.532	0.578	0.532	7.91	9.04	0.958	1.506
9	0.862	0.499	0.862	0.499	0.565	0.499	8.84	10.85	0.923	1.546
HUB	0.876	0.453	0.876	0.453	0.554	0.453	9.67	12.83	0.860	1.589

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
TIP	0.	13.7	0.0	5.3	0.474	0.	0.165	0.165	0.059	0.059
1	5.00	14.1	0.0	4.8	0.445	0.	0.131	0.131	0.046	0.046
2	10.00	14.3	0.0	4.5	0.424	0.	0.103	0.103	0.035	0.035
3	15.00	14.3	0.0	4.3	0.411	0.	0.082	0.082	0.027	0.027
4	30.00	13.1	-0.0	4.5	0.412	0.	0.053	0.053	0.017	0.017
5	50.00	11.2	0.0	5.1	0.433	0.	0.040	0.040	0.011	0.011
6	70.00	9.4	0.0	5.9	0.460	0.	0.048	0.045	0.012	0.011
7	85.00	8.1	0.0	6.8	0.485	0.	0.056	0.046	0.013	0.011
8	90.00	7.6	0.0	7.1	0.513	0.	0.130	0.116	0.029	0.026
9	95.00	7.2	0.0	7.4	0.557	0.	0.264	0.245	0.057	0.053
HUB	100.00	6.8	-0.0	7.6	0.616	0.	0.455	0.428	0.095	0.090

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TABLE V. - BLADE GEOMETRY FOR STATOR 9[a]

RP	PERCENT SPAN	RADII RI	 RO	BLADE ANGLES KIC	 KTC	 KOC	DELTA INC	CONE ANGLE
TIP	0.	23.414	23.409	23.77	14.42	-5.26	13.73	-0.162
1	5.	22.948	22.945	21.22	14.42	-4.82	14.11	-0.100
2	10.	22.478	22.475	19.49	14.48	-4.49	14.30	.125
3	15.	22.004	21.999	18.58	14.59	-4.29	14.30	-0.180
4	30.	20.577	20.575	20.32	15.70	-4.50	13.09	-0.060
5	50.	18.682	18.718	24.88	17.85	-5.14	11.19	1.156
6	70.	16.786	16.916	30.81	20.69	-5.94	9.39	4.176
7	85.	15.343	15.622	37.14	23.74	-6.78	8.06	9.026
8	90.	14.848	15.165	39.39	24.91	-7.08	7.64	10.248
9	95.	14.344	14.683	41.60	26.13	-7.35	7.22	10.973
HUB	100.	13.833	14.181	43.80	27.41	-7.62	6.83	11.305

RP	BLADE THICKNESSES TI	 TM	 TO	AXIAL DIMENSIONS ZIC	 ZMC	 ZTC	 ZOC
TIP	0.037	0.184	0.028	17.366	18.159	17.771	19.162
1	0.036	0.181	0.028	17.365	18.161	17.740	19.163
2	0.035	0.177	0.028	17.366	18.163	17.718	19.164
3	0.035	0.173	0.028	17.367	18.165	17.705	19.166
4	0.032	0.162	0.028	17.369	18.164	17.709	19.165
5	0.030	0.147	0.028	17.375	18.161	17.731	19.164
6	0.028	0.132	0.028	17.382	18.154	17.750	19.159
7	0.028	0.122	0.028	17.393	18.146	17.767	19.155
8	0.028	0.118	0.028	17.399	18.145	17.773	19.154
9	0.028	0.115	0.028	17.407	18.145	17.777	19.155
HUB	0.028	0.110	0.028	17.416	18.146	17.781	19.157

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	X FACTOR	PHISS	AREA RATIO
TIP	1.846	7.98	29.03	1.406	1.300	19.35	1.123
1	1.845	7.61	26.04	1.434	1.300	17.05	1.095
2	1.845	7.41	23.98	1.463	1.300	15.39	1.074
3	1.845	7.36	22.87	1.495	1.300	14.36	1.061
4	1.844	8.02	24.82	1.597	1.300	14.11	1.052
5	1.843	9.48	30.02	1.757	1.300	15.13	1.054
6	1.846	11.46	36.75	1.953	1.300	16.87	1.078
7	1.863	13.62	43.93	2.145	1.300	19.13	1.124
8	1.869	14.43	46.47	2.220	1.300	19.88	1.140
9	1.873	15.24	48.96	2.301	1.300	20.55	1.157
HUB	1.875	16.07	51.42	2.386	1.300	21.15	1.173

[a] The stator 9 blades that were fabricated and tested (both scale model and full size) were slightly larger than those from the aerodynamic design program tabulated here. Fabrication requirements for casting the full size stators resulted in a 0.0254-cm (0.010-in.) thickness being added completely around each blade section defined by the design program and then fabricating this enlarged blade. This enlargement was also duplicated for the 0.271-scale model by adding a 0.00686-cm (0.0027-in.) thickness to the design values. The resulting thickness-to-chord values actually tested are presented in figures 4(d) and (e) and 5. Other than these maximum thickness, or edge-thickness-to-chord values, no other geometry features were changed.

TABLE VI. - DESIGN BLADE-ELEMENT PARAMETERS FOR STATOR 9C

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
TIP	23.421	23.421	38.0	0.	38.0	0.	337.2	1.000	15.61	0.950
1	22.957	22.959	35.6	-0.	35.6	-0.	333.6	1.000	15.61	0.964
2	22.486	22.490	34.0	0.	34.0	0.	331.0	1.000	15.61	0.972
3	22.010	22.015	33.2	0.	33.2	0.	329.5	1.000	15.61	0.975
4	20.572	20.589	33.7	0.	33.7	0.	328.3	1.000	15.61	0.982
5	18.657	18.732	36.8	0.	36.8	0.	328.8	1.000	15.61	0.985
6	16.730	16.937	41.2	0.	41.2	0.	329.9	1.000	15.61	0.981
7	15.272	15.649	45.8	0.	45.8	0.	330.9	1.000	15.61	0.969
8	14.781	15.219	47.9	0.	47.9	0.	331.4	1.000	15.61	0.948
9	14.287	14.783	50.1	0.	50.1	0.	332.0	1.000	15.61	0.915
HUB	13.790	14.343	52.6	-0.	52.6	-0.	332.6	1.000	15.61	0.870

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
TIP	250.6	185.2	250.6	185.2	197.4	185.2	154.4	0.	0.	0.
1	250.5	190.2	250.5	190.2	203.8	190.2	145.7	-0.	0.	0.
2	251.4	193.6	251.4	193.6	208.5	193.6	140.4	0.	0.	0.
3	252.8	195.5	252.8	195.5	211.6	195.5	138.4	0.	0.	0.
4	258.7	198.0	258.7	198.0	215.2	198.0	143.7	0.	0.	0.
5	268.1	199.0	268.1	199.0	214.6	199.0	160.6	0.	0.	0.
6	278.8	199.6	278.8	199.6	209.8	199.6	183.6	0.	0.	0.
7	287.5	193.9	287.5	193.9	200.3	193.9	206.3	0.	0.	0.
8	290.8	187.3	290.8	187.3	195.1	187.3	215.7	0.	0.	0.
9	294.5	177.9	294.5	177.9	188.9	177.9	226.0	0.	0.	0.
HUB	298.7	165.7	298.7	165.7	181.6	165.7	237.2	-0.	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		STREAMLINE SLOPE		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
TIP	0.715	0.516	0.715	0.516	0.563	0.516	0.	0.	0.938	1.163
1	0.719	0.534	0.719	0.534	0.585	0.534	0.07	0.07	0.933	1.137
2	0.725	0.547	0.725	0.547	0.601	0.547	0.14	0.15	0.929	1.126
3	0.731	0.554	0.731	0.554	0.612	0.554	0.22	0.23	0.924	1.129
4	0.742	0.562	0.752	0.562	0.625	0.562	0.52	0.49	0.920	1.178
5	0.781	0.565	0.781	0.565	0.625	0.565	1.36	1.05	0.927	1.249
6	0.815	0.565	0.815	0.565	0.613	0.565	2.96	1.83	0.951	1.334
7	0.843	0.547	0.843	0.547	0.587	0.547	4.88	2.52	0.968	1.414
8	0.853	0.527	0.853	0.527	0.572	0.527	5.62	2.69	0.960	1.448
9	0.865	0.499	0.865	0.499	0.554	0.499	6.39	2.82	0.942	1.485
HUB	0.878	0.463	0.878	0.463	0.534	0.463	7.21	2.90	0.913	1.528

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
TIP	0.	17.6	5.0	4.9	0.464	0.	0.172	0.173	0.057	0.057
1	5.00	15.2	4.4	4.6	0.429	0.	0.125	0.125	0.040	0.040
2	10.00	13.0	3.8	4.4	0.406	0.	0.095	0.095	0.030	0.030
3	15.00	11.1	3.2	4.4	0.396	0.	0.082	0.082	0.025	0.025
4	30.00	7.6	2.2	4.6	0.396	0.	0.058	0.058	0.017	0.017
5	50.00	5.1	0.9	5.5	0.415	0.	0.045	0.045	0.012	0.012
6	70.00	3.5	-1.2	6.5	0.439	0.	0.055	0.053	0.013	0.013
7	85.00	1.7	-3.4	7.5	0.479	0.	0.084	0.078	0.018	0.017
8	90.00	0.5	-4.2	7.9	0.509	0	0.138	0.129	0.029	0.027
9	95.00	-0.6	-5.1	8.4	0.549	0.	0.221	0.208	0.045	0.042
HUB	100.00	-1.7	-6.0	8.9	0.598	0	0.330	0.311	0.065	0.061

TABLE VII. - BLADE GEOMETRY FOR STATOR 9C

	PERCENT	RADII		BLADE ANGLES			DELTA	CONE
RP	SPAN	RI	RO	KIC	KTC	KOC	INC	ANGLE
TIP	0.	23.421	23.421	20.38	17.27	-4.89	12.64	0.057
1	5.	22.957	22.959	20.42	15.51	-4.59	10.74	0.057
2	10.	22.486	22.490	21.00	14.35	-4.43	9.16	0.060
3	15.	22.010	22.015	22.12	13.82	-4.43	7.89	0.079
4	30.	20.572	20.589	26.10	13.68	-4.63	5.44	0.265
5	50.	18.657	18.732	31.77	16.98	-5.48	4.15	1.179
6	70.	16.730	16.937	37.64	21.43	-6.47	4.77	3.294
7	85.	15.272	15.649	44.10	25.64	-7.50	5.06	6.046
8	90.	14.781	15.219	47.25	27.20	-7.95	4.75	7.042
9	95.	14.287	14.783	50.57	28.93	-8.42	4.51	8.033
HUB	100.	13.790	14.343	54.15	30.81	-8.95	4.29	9.012

	BLADE THICKNESSES			AXIAL DIMENSIONS			
RP	TI	TM	TO	ZIC	ZMC	ZTC	ZOC
TIP	0.025	0.363	0.025	14.767	16.486	15.516	18.419
1	0.025	0.353	0.025	14.734	16.510	15.439	18.393
2	0.025	0.342	0.025	14.709	16.527	15.390	18.374
3	0.025	0.329	0.025	14.694	16.535	15.370	18.362
4	0.025	0.304	0.025	14.662	16.545	15.352	18.326
5	0.025	0.256	0.025	14.665	16.541	15.401	18.308
6	0.025	0.224	0.025	14.724	16.502	15.479	18.331
7	0.025	0.202	0.025	14.814	16.490	15.568	18.377
8	0.025	0.195	0.025	14.843	16.496	15.593	18.385
9	0.025	0.189	0.025	14.869	16.493	15.609	18.388
HUB	0.025	0.183	0.025	14.894	16.484	15.619	18.385

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	X FACTOR	PHISS	AREA RATIO
TIP	3.721	8.87	25.27	1.517	1.000	10.65	1.122
1	3.721	7.95	25.01	1.548	1.060	9.92	1.100
2	3.721	7.40	25.43	1.580	1.120	9.70	1.086
3	3.723	7.22	26.55	1.615	1.182	10.01	1.080
4	3.721	7.54	30.73	1.726	1.313	11.71	1.071
5	3.722	9.75	37.24	1.901	1.300	13.91	1.090
6	3.727	12.54	44.11	2.114	1.300	17.20	1.107
7	3.740	15.29	51.61	2.310	1.300	20.56	1.103
8	3.747	16.41	55.19	2.385	1.300	21.95	1.100
9	3.754	17.62	58.99	2.466	1.300	23.42	1.097
HUB	3.763	18.94	63.09	2.554	1.300	24.99	1.095

TABLE VIII. - DESIGN BLADE-ELEMENT PARAMETERS FOR STATOR 9D

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
TIP	23.421	23.421	37.0	-0.	37.0	-0.	335.7	0.999	15.57	0.977
1	22.958	22.970	34.8	0.	34.8	0.	332.6	1.000	15.57	0.979
2	22.484	22.504	33.3	-0.	33.3	-0.	350.3	1.000	15.57	0.982
3	22.005	22.028	32.6	-0.	32.6	-0.	328.8	1.000	15.57	0.984
4	20.559	20.587	33.4	-0.	33.4	-0.	327.8	1.000	15.57	0.984
5	18.640	18.701	36.5	-0.	36.5	-0.	328.3	1.000	15.57	0.980
6	16.722	16.883	40.5	-0.	40.5	-0.	329.0	1.000	15.57	0.975
7	15.285	15.586	45.0	-0.	45.0	-0.	330.3	1.000	15.57	0.963
8	14.802	15.174	47.1	-0.	47.1	-0.	331.0	1.000	15.57	0.956
9	14.318	14.773	49.7	-0.	49.7	-0.	331.8	1.000	15.57	0.948
HUB	13.838	14.389	52.5	-0.	52.5	-0.	332.6	1.000	15.57	0.939

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
TIP	250.7	192.9	250.7	192.9	200.3	192.0	150.7	-0.	0.	0.
1	250.9	193.5	250.0	193.5	206.0	193.5	143.2	0.	0.	0.
2	251.6	194.2	251.6	194.2	210.3	194.2	138.2	-0.	0.	0.
3	252.7	194.9	252.7	194.9	213.0	194.9	136.0	-0.	0.	0.
4	257.7	195.8	257.7	195.8	215.0	195.8	142.0	-0.	0.	0.
5	266.2	196.6	266.2	196.8	214.0	196.6	158.4	-0.	0.	0.
6	277.0	198.7	277.0	198.7	210.7	198.7	179.8	-0.	0.	0.
7	287.5	198.5	287.5	198.5	203.5	198.5	203.2	-0.	0.	0.
8	290.0	199.1	290.9	199.1	197.9	199.1	213.2	-0.	0.	0.
9	294.4	200.2	294.4	200.2	190.5	200.2	224.5	-0.	0.	0.
HUB	298.4	201.7	298.4	201.7	181.5	201.7	236.8	-0.	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		STREAMLINE SLOPE		MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
TIP	0.717	0.541	0.717	0.541	0.575	0.541	-0.17	0.04	0.963	1.032
1	0.721	0.545	0.721	0.545	0.592	0.545	0.02	0.18	0.939	1.001
2	0.726	0.549	0.726	0.549	0.607	0.549	0.15	0.29	0.923	0.982
3	0.731	0.552	0.731	0.552	0.616	0.552	0.23	0.36	0.915	0.975
4	0.749	0.556	0.749	0.556	0.625	0.556	0.47	0.56	0.911	0.997
5	0.776	0.558	0.776	0.558	0.624	0.558	1.16	1.04	0.919	1.032
6	0.810	0.563	0.810	0.563	0.616	0.565	2.71	2.02	0.943	1.065
7	0.844	0.562	0.844	0.562	0.597	0.562	4.79	3.30	0.976	1.102
8	0.854	0.583	0.854	0.563	0.581	0.563	5.85	3.92	1.006	1.117
9	0.865	0.566	0.865	0.566	0.580	0.566	7.12	4.64	1.051	1.134
HUB	0.877	0.569	0.877	0.569	0.533	0.569	8.57	5.43	1.111	1.153

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
TIP	0.	0.5	-6.4	9.9	0.429	0.	0.069	0.060	0.025	0.023
1	5.00	0.7	-6.0	9.0	0.413	0.	0.066	0.066	0.021	0.021
2	10.00	1.0	-5.6	8.3	0.402	0.	0.060	0.060	0.019	0.019
3	15.00	1.2	-5.1	7.8	0.395	0.	0.054	0.054	0.017	0.017
4	30.00	1.8	-3.8	7.5	0.399	0.	0.052	0.052	0.015	0.015
5	50.00	2.5	-2.0	8.0	0.418	0.	0.061	0.061	0.016	0.016
6	70.00	2.4	-1.0	8.8	0.435	0.	0.072	0.072	0.017	0.017
7	85.00	2.2	-0.5	9.6	0.461	0.	0.101	0.101	0.022	0.022
8	90.00	2.0	-0.4	10.1	0.468	0.	0.118	0.118	0.025	0.025
9	95.00	1.8	-0.3	10.6	0.473	0.	0.136	0.136	0.028	0.028
HUB	100.00	1.5	-0.4	11.2	0.477	0.	0.155	0.155	0.031	0.031

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TABLE IX. - BLADE GEOMETRY FOR STATOR 9D

	PERCENT	RADII		BLADE ANGLES			DELTA	CONE
RP	SPAN	RI	RO	KIC	KTC	KOC	INC	ANGLE
TIP	0.	23.421	23.421	36.51	15.77	-9.88	6.86	0.057
1	5.	22.958	22.970	34.07	15.11	-8.97	6.71	0.194
2	10.	22.484	22.504	32.34	15.01	-8.25	6.53	0.315
3	15.	22.005	22.028	31.37	15.50	-7.77	6.31	0.361
4	30.	20.559	20.587	31.69	18.43	-7.53	5.55	0.449
5	50.	18.640	18.701	34.01	23.45	-8.04	4.53	0.932
6	70.	16.722	16.883	38.04	29.09	-8.79	3.45	2.603
7	85.	15.285	15.586	42.80	34.47	-9.63	2.67	4.965
8	90.	14.802	15.174	45.10	36.79	-10.07	2.41	6.183
9	95.	14.318	14.773	47.83	39.42	-10.60	2.15	7.661
HUB	100.	13.838	14.389	50.93	42.30	-11.19	1.91	9.376

	BLADE THICKNESS			AXIAL DIMENSIONS			
RP	TI	TM	TO	ZI	ZMC	ZTC	ZO
TIP	0.036	0.268	0.036	24.996	26.700	26.735	28.596
1	0.036	0.262	0.036	24.978	26.712	26.702	28.592
2	0.036	0.257	0.035	24.964	26.722	26.640	28.588
3	0.035	0.251	0.035	24.955	26.731	26.547	28.584
4	0.033	0.234	0.033	24.949	26.750	26.334	28.570
5	0.031	0.210	0.031	24.962	26.763	26.198	28.549
6	0.029	0.188	0.028	24.994	26.776	26.119	28.525
7	0.027	0.171	0.027	25.041	26.777	26.065	28.505
8	0.026	0.165	0.026	25.068	26.775	26.051	28.496
9	0.026	0.160	0.026	25.104	26.772	26.038	28.491
HUB	0.026	0.154	0.026	25.146	26.769	26.028	28.484

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	TURN RATE	PHISS	CHOKE MARGIN
TIP	3.721	14.77	46.39	1.517	0.780	16.58	0.090
1	3.721	13.84	43.04	1.547	0.789	14.63	0.079
2	3.721	13.19	40.60	1.580	0.798	13.16	0.072
3	3.721	12.84	39.14	1.614	0.808	12.19	0.058
4	3.721	13.36	39.21	1.727	0.759	10.85	0.064
5	3.721	15.50	42.05	1.903	0.574	9.05	0.055
6	3.724	18.43	46.83	2.116	0.439	7.58	0.038
7	3.733	21.43	52.43	2.310	0.371	6.87	0.023
8	3.738	22.76	55.17	2.382	0.355	6.80	0.023
9	3.747	24.29	58.43	2.460	0.343	6.82	0.025
HUB	3.762	26.00	62.12	2.545	0.335	6.95	0.031

TABLE X. - OVERALL PERFORMANCE OF STAGE 15-9[a] - EFFECTS OF SPEED AND FLOW

[Rotor-exit instrumentation at station 2a unless otherwise noted; stator at design setting angle; axial spacing, 3.5 rotor chords.]

Parameter	Percent of design speed								
	100								
	Reading								
	558	538	560	539	543	551	[b]600	[b]601	[b]602
ROTOR TOTAL PRESSURE RATIO	1.471	1.480	1.510	1.513	1.525	1.547	1.453	1.481	1.535
STAGE TOTAL PRESSURE RATIO	1.397	1.432	1.460	1.463	1.481	1.484	1.409	1.448	1.485
ROTOR TOTAL TEMPERATURE RATIO	1.132	1.134	1.137	1.139	1.140	1.146	1.129	1.133	1.145
STAGE TOTAL TEMPERATURE RATIO	1.131	1.133	1.137	1.138	1.140	1.146	1.130	1.134	1.146
ROTOR TEMP. RISE EFFICIENCY	0.885	0.886	0.910	0.907	0.915	0.908	0.875	0.890	0.895
STAGE TEMP. RISE EFFICIENCY	0.763	0.812	0.831	0.830	0.846	0.821	0.790	0.833	0.821
ROTOR MOMENTUM RISE EFFICIENCY	0.862	0.883	0.882	0.898	0.904	0.905	0.853	0.887	0.896
ROTOR HEAD RISE COEFFICIENT	0.295	0.300	0.316	0.318	0.324	0.337	0.287	0.304	0.330
STAGE HEAD RISE COEFFICIENT	0.253	0.274	0.288	0.290	0.300	0.303	0.262	0.285	0.303
FLOW COEFFICIENT	0.525	0.518	0.516	0.510	0.511	0.494	0.523	0.516	0.495
WT FLOW PER UNIT FRONTAL AREA	152.07	151.49	149.65	148.87	148.15	143.67	151.33	149.23	144.55
WT FLOW PER UNIT ANNULUS AREA	202.50	201.73	199.28	198.24	197.29	191.31	201.52	198.72	192.49
WT FLOW AT ORIFICE	29.26	29.15	28.80	28.65	28.51	27.65	29.12	28.72	27.82
WT FLOW AT ROTOR INLET	29.54	29.25	29.24	28.94	28.99	28.19	29.38	29.09	28.22
WT FLOW AT ROTOR OUTLET	29.67	29.76	29.19	29.45	29.51	28.89	29.00	28.64	28.20
WT FLOW AT STATOR OUTLET	30.25	29.87	29.22	29.20	29.61	28.81	30.10	29.27	29.10
ROTATIVE SPEED	13053.3	13041.9	13065.6	13057.2	13051.8	13025.9	13004.5	12982.2	13039.2
PERCENT OF DESIGN SPEED	100.3	100.2	100.4	100.3	100.2	100.0	99.9	99.7	100.1
PERCENT DESIGN WT FLOW AT ORIFICE	100.3	100.0	98.8	98.2	97.8	94.8	99.8	98.5	95.4

Parameter	Percent of design speed							
	90							80
	Reading							
	564	565	566	567	568	580	545	572
ROTOR TOTAL PRESSURE RATIO	1.367	1.379	1.402	1.415	1.421	1.405	1.398	1.300
STAGE TOTAL PRESSURE RATIO	1.320	1.346	1.367	1.377	1.376	1.355	1.334	1.243
ROTOR TOTAL TEMPERATURE RATIO	1.102	1.103	1.108	1.113	1.116	1.116	1.121	1.099
STAGE TOTAL TEMPERATURE RATIO	1.102	1.104	1.108	1.112	1.116	1.115	1.120	1.098
ROTOR TEMP. RISE EFFICIENCY	0.917	0.929	0.936	0.926	0.912	0.881	0.827	0.788
STAGE TEMP. RISE EFFICIENCY	0.806	0.851	0.862	0.852	0.830	0.787	0.715	0.657
ROTOR MOMENTUM RISE EFFICIENCY	0.893	0.899	0.906	0.897	0.887	0.856	0.817	0.767
ROTOR HEAD RISE COEFFICIENT	0.292	0.300	0.316	0.324	0.329	0.322	0.315	0.308
STAGE HEAD RISE COEFFICIENT	0.259	0.276	0.291	0.298	0.299	0.287	0.269	0.253
FLOW COEFFICIENT	0.539	0.534	0.514	0.492	0.467	0.437	0.409	0.355
WT FLOW PER UNIT FRONTAL AREA	143.78	142.68	138.42	133.89	128.38	120.89	114.37	91.46
WT FLOW PER UNIT ANNULUS AREA	191.47	190.01	184.32	178.30	170.96	160.98	152.30	121.80
WT FLOW AT ORIFICE	27.67	27.46	26.64	25.77	24.71	23.26	22.01	17.60
WT FLOW AT ROTOR INLET	27.86	27.69	26.91	26.02	24.97	23.49	22.23	17.66
WT FLOW AT ROTOR OUTLET	27.99	27.79	27.11	26.25	25.31	23.97	22.94	17.93
WT FLOW AT STATOR OUTLET	28.47	27.95	27.09	26.32	25.43	23.91	22.82	18.25
ROTATIVE SPEED	11727.0	11747.4	11748.6	11766.6	11764.5	11676.5	11716.6	10446.3
PERCENT OF DESIGN SPEED	90.1	90.2	90.2	90.4	90.4	89.7	90.0	80.2
PERCENT DESIGN WT FLOW AT ORIFICE	94.9	94.2	91.4	88.4	84.7	79.8	75.5	60.4

Parameter	Percent of design speed							
	70						60	50
	Reading							
	573	574	575	576	550	577	578	579
ROTOR TOTAL PRESSURE RATIO	1.194	1.210	1.229	1.231	1.225	1.227	1.162	1.101
STAGE TOTAL PRESSURE RATIO	1.177	1.195	1.211	1.204	1.185	1.183	1.133	1.090
ROTOR TOTAL TEMPERATURE RATIO	1.055	1.060	1.066	1.071	1.075	1.076	1.055	1.034
STAGE TOTAL TEMPERATURE RATIO	1.056	1.060	1.066	1.071	1.074	1.076	1.055	1.032
ROTOR TEMP. RISE EFFICIENCY	0.937	0.941	0.922	0.862	0.800	0.792	0.791	0.821
STAGE TEMP. RISE EFFICIENCY	0.855	0.867	0.851	0.770	0.673	0.650	0.659	0.771
ROTOR MOMENTUM RISE EFFICIENCY	0.926	0.923	0.909	0.856	0.806	0.776	0.784	0.787
ROTOR HEAD RISE COEFFICIENT	0.270	0.290	0.314	0.316	0.312	0.312	0.310	0.285
STAGE HEAD RISE COEFFICIENT	0.248	0.270	0.290	0.281	0.259	0.254	0.256	0.255
FLOW COEFFICIENT	0.561	0.518	0.457	0.398	0.353	0.343	0.336	0.362
WT FLOW PER UNIT FRONTAL AREA	121.12	113.40	101.50	89.49	79.84	77.80	65.67	55.05
WT FLOW PER UNIT ANNULUS AREA	161.29	151.01	135.16	119.18	106.32	103.60	87.45	73.30
WT FLOW AT ORIFICE	23.31	21.82	19.53	17.22	15.36	14.97	12.64	10.59
WT FLOW AT ROTOR INLET	23.48	21.98	19.72	17.37	15.41	15.05	12.73	10.51
WT FLOW AT ROTOR OUTLET	23.46	22.02	19.88	17.76	16.00	15.26	12.98	11.13
WT FLOW AT STATOR OUTLET	23.38	21.90	19.72	17.60	15.83	15.51	13.13	11.00
ROTATIVE SPEED	9107.2	9125.1	9132.3	9127.5	9085.2	9124.0	7808.1	6497.0
PERCENT OF DESIGN SPEED	69.9	70.1	70.1	70.1	69.8	70.1	60.0	49.9
PERCENT DESIGN WT FLOW AT ORIFICE	79.9	74.8	67.0	59.0	52.7	51.3	43.3	36.3

[a] From ref. 4.

[b] Rotor-exit instrumentation at station 2b.

TABLE XI. - OVERALL PERFORMANCE OF STAGE 15-9R[a] - EFFECTS OF SPEED AND FLOW

[Rotor-exit instrumentation at station 2a unless otherwise noted; stator reset 3.7°, closed; axial spacing, 3.5 rotor chords.]

Parameter	Percent of design speed										
	100							90			
	Reading										
	678	680	684	683	b704	b709	b707	686	687	688	689
ROTOR TOTAL PRESSURE RATIO	1.510	1.522	1.545	1.525	1.501	1.534	1.507	1.396	1.419	1.406	1.399
STAGE TOTAL PRESSURE RATIO	1.424	1.469	1.494	1.465	1.470	1.501	1.458	1.361	1.385	1.364	1.346
ROTOR TOTAL TEMPERATURE RATIO	1.137	1.139	1.147	1.147	1.138	1.146	1.149	1.107	1.114	1.119	1.122
STAGE TOTAL TEMPERATURE RATIO	1.137	1.138	1.146	1.146	1.137	1.147	1.148	1.107	1.114	1.118	1.121
ROTOR TEMP. RISE EFFICIENCY	0.914	0.918	0.902	0.872	0.892	0.889	0.836	0.931	0.924	0.861	0.823
STAGE TEMP. RISE EFFICIENCY	0.778	0.841	0.851	0.789	0.848	0.837	0.771	0.859	0.858	0.786	0.735
ROTOR MOMENTUM RISE EFFICIENCY	0.883	0.889	0.867	0.832	0.869	0.875	0.823	0.898	0.890	0.838	0.799
ROTOR HEAD RISE COEFFICIENT	0.315	0.321	0.335	0.325	0.314	0.330	0.315	0.312	0.330	0.320	0.314
STAGE HEAD RISE COEFFICIENT	0.268	0.293	0.308	0.292	0.296	0.312	0.288	0.288	0.306	0.290	0.276
FLOW COEFFICIENT	0.521	0.518	0.476	0.444	0.514	0.494	0.438	0.523	0.479	0.417	0.396
WT FLOW PER UNIT FRONTAL AREA	152.04	151.26	140.47	134.25	149.63	144.09	132.14	140.66	130.72	117.24	111.88
WT FLOW PER UNIT ANNULUS AREA	202.46	201.43	187.06	178.77	199.26	191.88	175.97	187.31	174.05	156.12	148.99
WT FLOW AT ORIFICE	29.26	29.11	27.03	25.83	28.80	27.73	25.43	27.07	25.15	22.56	21.53
WT FLOW AT ROTOR INLET	29.38	29.31	27.44	26.08	29.04	28.09	25.78	27.26	25.39	22.68	21.69
WT FLOW AT ROTOR OUTLET	30.04	29.91	28.18	26.68	28.59	28.00	25.52	27.91	26.16	23.63	22.45
WT FLOW AT STATOR OUTLET	30.26	29.91	28.16	26.68	29.65	29.27	26.35	27.79	25.84	23.26	22.15
ROTATIVE SPEED	13066.2	13080.8	13043.6	13036.6	13007.6	13040.5	13036.7	11748.1	11719.3	11733.7	11759.5
PERCENT OF DESIGN SPEED	100.4	100.5	100.2	100.1	99.9	100.2	100.1	90.2	90.0	90.1	90.3
PERCENT DESIGN WT FLOW AT ORIFICE	100.3	99.7	92.7	88.6	98.8	95.1	87.2	92.8	86.2	77.4	73.8

Parameter	Percent of design speed						
	80	70				60	50
	Reading						
	692	693	694	695	696	699	700
ROTOR TOTAL PRESSURE RATIO	1.302	1.193	1.219	1.252	1.227	1.163	1.112
STAGE TOTAL PRESSURE RATIO	1.256	1.172	1.204	1.214	1.193	1.139	1.096
ROTOR TOTAL TEMPERATURE RATIO	1.099	1.055	1.062	1.069	1.076	1.056	1.039
STAGE TOTAL TEMPERATURE RATIO	1.098	1.056	1.062	1.069	1.075	1.055	1.039
ROTOR TEMP. RISE EFFICIENCY	0.790	0.936	0.939	0.888	0.795	0.791	0.802
STAGE TEMP. RISE EFFICIENCY	0.685	0.833	0.872	0.821	0.689	0.683	0.691
ROTOR MOMENTUM RISE EFFICIENCY	0.772	0.927	0.934	0.887	0.785	0.773	0.785
ROTOR HEAD RISE COEFFICIENT	0.308	0.268	0.302	0.318	0.310	0.310	0.311
STAGE HEAD RISE COEFFICIENT	0.265	0.241	0.282	0.294	0.267	0.266	0.268
FLOW COEFFICIENT	0.351	0.561	0.493	0.415	0.342	0.328	0.325
WT FLOW PER UNIT FRONTAL AREA	90.83	121.68	108.79	93.24	77.98	64.53	55.78
WT FLOW PER UNIT ANNULUS AREA	120.95	162.03	144.88	124.17	103.84	85.93	71.62
WT FLOW AT ORIFICE	17.48	23.42	20.94	17.94	15.01	12.42	10.35
WT FLOW AT ROTOR INLET	17.49	23.50	21.05	18.04	15.06	12.50	10.41
WT FLOW AT ROTOR OUTLET	18.20	23.96	21.61	18.76	15.69	12.92	10.85
WT FLOW AT STATOR OUTLET	18.19	23.94	21.12	18.28	15.59	12.95	10.76
ROTATIVE SPEED	10462.4	9121.4	9118.5	9127.6	9139.1	7820.5	6543.3
PERCENT OF DESIGN SPEED	80.4	70.1	70.0	70.1	70.2	60.1	50.3
PERCENT DESIGN WT FLOW AT ORIFICE	59.9	80.3	71.8	61.5	51.5	42.6	35.5

[a] From ref. 4.

[b] Rotor-exit instrumentation at station 2b.

TABLE XII. - OVERALL PERFORMANCE OF STAGE 15-9C - EFFECTS OF SPEED AND FLOW

[Rotor-exit instrumentation at station 2a; stator at design setting angle; axial spacing, 2.9 rotor chords.]

Parameter	Percent of design speed						
	100				90		
	Reading						
	1331	1332	1333	1335	1326	1327	1328
ROTOR TOTAL PRESSURE RATIO	1.446	1.536	1.547	1.544	1.367	1.419	1.392
STAGE TOTAL PRESSURE RATIO	1.399	1.484	1.487	1.476	1.336	1.382	1.326
ROTOR TOTAL TEMPERATURE RATIO	1.130	1.145	1.148	1.150	1.104	1.116	1.126
STAGE TOTAL TEMPERATURE RATIO	1.128	1.144	1.148	1.149	1.104	1.116	1.123
ROTOR TEMP. RISE EFFICIENCY	0.853	0.902	0.898	0.883	0.896	0.903	0.788
STAGE TEMP. RISE EFFICIENCY	0.786	0.831	0.813	0.788	0.829	0.833	0.680
ROTOR MOMENTUM RISE EFFICIENCY	0.872	0.909	0.901	0.882	0.926	0.920	0.782
ROTOR HEAD RISE COEFFICIENT	0.282	0.333	0.337	0.334	0.291	0.327	0.308
STAGE HEAD RISE COEFFICIENT	0.255	0.305	0.305	0.298	0.269	0.302	0.261
FLOW COEFFICIENT	0.516	0.496	0.474	0.454	0.527	0.472	0.385
WT FLOW PER UNIT FRONTAL AREA	152.25	146.74	142.11	137.33	143.36	131.47	109.68
WT FLOW PER UNIT ANNULUS AREA	202.81	195.47	189.30	182.93	190.97	175.13	46.11
WT FLOW AT ORIFICE	29.30	28.24	27.35	26.43	27.59	25.30	21.11
WT FLOW AT ROTOR INLET	29.16	28.28	27.38	26.50	27.44	25.19	21.16
WT FLOW AT ROTOR OUTLET	30.04	29.31	28.53	27.80	28.26	26.20	21.92
WT FLOW AT STATOR OUTLET	30.24	29.71	29.01	28.29	28.31	26.51	22.79
ROTATIVE SPEED	13038.0	12999.1	13023.3	13050.1	11756.8	11759.1	11767.0
PERCENT OF DESIGN SPEED	100.1	99.8	100.0	100.2	90.3	90.3	90.4
PERCENT DESIGN WT FLOW AT ORIFICE	100.5	96.8	93.8	90.6	94.6	86.8	72.4

Parameter	Percent of design speed				
	80	70			60
	Reading				
	1325	1323	1320	1321	1318
ROTOR TOTAL PRESSURE RATIO	1.298	1.187	1.225	1.225	1.163
STAGE TOTAL PRESSURE RATIO	1.238	1.168	1.207	1.179	1.133
ROTOR TOTAL TEMPERATURE RATIO	1.101	1.055	1.066	1.077	1.056
STAGE TOTAL TEMPERATURE RATIO	1.100	1.056	1.066	1.076	1.056
ROTOR TEMP. RISE EFFICIENCY	0.769	0.909	0.903	0.774	0.780
STAGE TEMP. RISE EFFICIENCY	0.627	0.815	0.841	0.636	0.647
ROTOR MOMENTUM RISE EFFICIENCY	0.765	0.961	0.935	0.776	0.783
ROTOR HEAD RISE COEFFICIENT	0.307	0.261	0.312	0.310	0.308
STAGE HEAD RISE COEFFICIENT	0.249	0.256	0.289	0.253	0.255
FLOW COEFFICIENT	0.336	0.566	0.458	0.330	0.327
WT FLOW PER UNIT FRONTAL AREA	87.99	123.87	102.66	75.81	65.50
WT FLOW PER UNIT ANNULUS AREA	117.21	165.00	136.75	100.99	87.25
WT FLOW AT ORIFICE	16.93	23.84	19.76	14.59	12.61
WT FLOW AT ROTOR INLET	16.72	23.65	19.64	14.43	12.47
WT FLOW AT ROTOR OUTLET	17.62	24.24	20.36	15.18	13.10
WT FLOW AT STATOR OUTLET	18.34	23.87	20.35	15.82	13.62
ROTATIVE SPEED	10422.9	9106.4	9070.2	9067.1	7841.8
PERCENT OF DESIGN SPEED	80.1	69.9	69.7	69.6	60.2
PERCENT DESIGN WT FLOW AT ORIFICE	58.0	81.8	67.8	50.8	43.2

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TABLE XIII. - OVERALL PERFORMANCE OF STAGE 15-9D - EFFECTS OF SPEED AND FLOW

[Rotor-exit instrumentation at station 2b'; stator at design setting angle; axial spacing, 2.9 rotor chords.]

Parameter	Percent of design speed								
	100								
	Reading								
	3160	3188	3161	3187	3162	3185	3181	3183	3164
ROTOR TOTAL PRESSURE RATIO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STAGE TOTAL PRESSURE RATIO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR TOTAL TEMPERATURE RATIO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STAGE TOTAL TEMPERATURE RATIO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR TEMP. RISE EFFICIENCY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STAGE TEMP. RISE EFFICIENCY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR MOMENTUM RISE EFFICIENCY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR HEAD RISE COEFFICIENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STAGE HEAD RISE COEFFICIENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FLOW COEFFICIENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW PER UNIT FRONTAL AREA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW PER UNIT ANNULUS AREA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW AT ORIFICE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW AT ROTOR INLET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.88	25.99
WT FLOW AT ROTOR OUTLET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	28.24	[illegible]	26.66
WT FLOW AT STATOR OUTLET	[illegible]	[illegible]	31.45	[illegible]	[illegible]	29.66	[illegible]	[illegible]	[illegible]
ROTATIVE SPEED	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12992.8	12996.8
PERCENT OF DESIGN SPEED	[illegible]	[illegible]	99.9	[illegible]	[illegible]	[illegible]	99.8	99.8	99.8
PERCENT DESIGN WT FLOW AT ORIFICE	100.2	99.9	99.2	98.6	96.7	95.7	93.3	90.5	87.5

Parameter	Percent of design speed					
	90					80
	Reading					
	3180	3179	3178	3165	3166	3167
ROTOR TOTAL PRESSURE RATIO	[illegible]	[illegible]	[illegible]	1.436	[illegible]	[illegible]
STAGE TOTAL PRESSURE RATIO	1.549	1.576	[illegible]	1.382	1.365	[illegible]
ROTOR TOTAL TEMPERATURE RATIO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STAGE TOTAL TEMPERATURE RATIO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR TEMP. RISE EFFICIENCY	[illegible]	[illegible]	0.916	0.888	[illegible]	[illegible]
STAGE TEMP. RISE EFFICIENCY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR MOMENTUM RISE EFFICIENCY	[illegible]	[illegible]	0.954	0.921	0.882	[illegible]
ROTOR HEAD RISE COEFFICIENT	[illegible]	[illegible]	0.523	[illegible]	[illegible]	[illegible]
STAGE HEAD RISE COEFFICIENT	[illegible]	[illegible]	0.518	[illegible]	[illegible]	[illegible]
FLOW COEFFICIENT	[illegible]	[illegible]	0.482	0.449	[illegible]	[illegible]
WT FLOW PER UNIT FRONTAL AREA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	89.58
WT FLOW PER UNIT ANNULUS AREA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW AT ORIFICE	[illegible]	[illegible]	25.15	[illegible]	[illegible]	[illegible]
WT FLOW AT ROTOR INLET	[illegible]	[illegible]	[illegible]	[illegible]	22.49	[illegible]
WT FLOW AT ROTOR OUTLET	[illegible]	[illegible]	25.69	24.61	[illegible]	[illegible]
WT FLOW AT STATOR OUTLET	[illegible]	27.53	26.44	24.95	23.25	18.35
ROTATIVE SPEED	[illegible]	[illegible]	11729.2	[illegible]	[illegible]	[illegible]
PERCENT OF DESIGN SPEED	[illegible]	[illegible]	[illegible]	89.8	[illegible]	[illegible]
PERCENT DESIGN WT FLOW AT ORIFICE	93.1	90.1	86.2	81.4	75.8	59.2

Parameter	Percent of design speed						
	70					60	50
	Reading						
	3174	3171	3170	3169	3168	3175	3176
ROTOR TOTAL PRESSURE RATIO	[illegible]	[illegible]	[illegible]	1.226	[illegible]	1.159	[illegible]
STAGE TOTAL PRESSURE RATIO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR TOTAL TEMPERATURE RATIO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STAGE TOTAL TEMPERATURE RATIO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR TEMP. RISE EFFICIENCY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STAGE TEMP. RISE EFFICIENCY	0.862	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR MOMENTUM RISE EFFICIENCY	0.924	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTOR HEAD RISE COEFFICIENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STAGE HEAD RISE COEFFICIENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FLOW COEFFICIENT	0.542	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW PER UNIT FRONTAL AREA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW PER UNIT ANNULUS AREA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW AT ORIFICE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW AT ROTOR INLET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW AT ROTOR OUTLET	[illegible]	21.64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WT FLOW AT STATOR OUTLET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ROTATIVE SPEED	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7789.4	6514.5
PERCENT OF DESIGN SPEED	[illegible]	[illegible]	[illegible]	69.8	69.7	59.8	[illegible]
PERCENT DESIGN WT FLOW AT ORIFICE	77.3	72.7	66.7	58.0	50.5	42.4	36.4

TABLE XIV. - BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9

(a) 100 Percent of design speed; reading 1331

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	25.3	6.2	25.3	6.2	323.3	0.996	13.78	0.933
2	22.487	22.489	24.7	5.7	24.7	5.7	322.6	0.998	13.92	0.954
3	22.012	22.014	24.9	3.7	24.9	3.7	322.3	0.998	13.99	0.973
4	20.571	20.589	27.0	1.2	27.0	1.2	323.3	0.999	14.39	0.982
5	18.656	18.732	30.5	0.0	30.5	0.0	324.5	1.000	14.61	0.987
6	16.728	16.937	35.8	-1.0	35.8	-1.0	328.2	0.996	15.17	0.975
7	15.273	15.649	41.4	0.4	41.4	0.4	331.5	0.996	15.80	0.950
8	14.780	15.220	44.1	2.2	44.1	2.2	332.3	0.996	15.92	0.914
9	14.287	14.783	48.0	1.8	48.0	1.8	332.5	0.996	15.39	0.911

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	246.2	191.8	246.2	191.8	222.6	190.7	105.2	20.9	0.	0.
2	252.1	206.1	252.1	206.1	229.0	205.1	105.3	20.3	0.	0.
3	254.9	215.7	254.9	215.7	231.2	215.3	107.3	13.8	0.	0.
4	268.3	228.9	268.3	228.9	239.0	228.8	121.9	4.9	0.	0.
5	282.8	238.1	282.8	238.1	243.5	238.1	143.7	0.2	0.	0.
6	302.0	248.7	302.0	248.7	245.1	248.7	176.5	-4.3	0.	0.
7	314.9	253.7	314.9	253.7	236.2	253.7	208.2	1.8	0.	0.
8	313.3	241.8	313.3	241.8	225.0	241.6	218.0	9.4	0.	0.
9	302.4	228.3	302.4	228.3	202.3	228.2	224.8	7.0	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.718	0.549	0.718	0.549	0.649	0.546	0.123	0.857	0.876
2	0.737	0.593	0.737	0.593	0.670	0.590	0.112	0.896	0.905
3	0.747	0.623	0.747	0.623	0.677	0.621	0.066	0.931	0.936
4	0.789	0.663	0.789	0.663	0.703	0.662	0.038	0.957	1.055
5	0.836	0.690	0.836	0.690	0.720	0.690	0.041	0.978	1.157
6	0.896	0.721	0.896	0.721	0.727	0.721	0.037	1.015	1.302
7	0.935	0.733	0.935	0.733	0.702	0.733	0.048	1.074	2.353
8	0.929	0.694	0.929	0.694	0.667	0.694	0.114	1.074	2.430
9	0.891	0.652	0.891	0.652	0.596	0.652	0.145	1.128	2.495

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	4.9	-5.9	10.8	0.332	0.	0.230	0.230	0.074	0.074
2	10.00	3.7	-5.5	10.1	0.289	0.	0.151	0.151	0.048	0.048
3	15.00	2.8	-5.1	8.1	0.267	0.	0.087	0.087	0.027	0.027
4	30.00	0.9	-4.5	5.9	0.273	0.	0.055	0.055	0.016	0.016
5	50.00	-1.2	-5.4	5.5	0.291	0.	0.036	0.036	0.009	0.009
6	70.00	-1.9	-6.7	5.5	0.317	0.	0.061	0.059	0.015	0.014
7	85.00	-2.8	-7.8	7.9	0.334	0.	0.117	-0.166	0.025	-0.036
8	90.00	-3.2	-8.0	10.2	0.366	0.	0.203	-0.116	0.042	-0.024
9	95.00	-2.7	-7.2	10.2	0.389	0.	0.221	-0.130	0.045	-0.026

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9C

(b) 100 Percent of design speed; reading 1332

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	33.3	5.6	33.3	5.6	333.1	0.997	15.62	0.940
2	22.487	22.489	32.0	4.8	32.0	4.8	331.8	0.998	15.67	0.957
3	22.012	22.014	32.3	3.7	32.3	3.7	330.3	1.000	15.60	0.967
4	20.571	20.589	34.3	1.3	34.3	1.3	329.4	0.999	15.53	0.972
5	18.656	18.732	36.1	0.2	36.1	0.2	328.4	1.000	15.49	0.976
6	16.728	16.937	40.0	-0.2	40.0	-0.2	328.3	1.003	15.51	0.988
7	15.273	15.649	45.3	1.7	45.3	1.7	330.2	0.998	15.65	0.959
8	14.780	15.220	48.0	3.2	48.0	3.2	330.6	0.997	15.76	0.930
9	14.287	14.783	51.0	0.2	51.0	0.2	331.3	0.997	15.56	0.925

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	251.8	194.7	251.8	194.7	210.5	193.8	138.2	18.9	0.	0.
2	254.9	203.2	254.9	203.2	216.1	202.5	135.2	17.1	0.	0.
3	255.7	205.0	255.7	205.0	216.3	204.5	136.5	13.1	0.	0.
4	259.0	202.4	259.0	202.4	213.9	202.3	146.0	4.4	0.	0.
5	272.6	209.2	272.6	209.2	220.2	209.2	160.7	0.9	0.	0.
6	281.3	216.6	281.3	216.6	215.6	216.6	180.8	-0.8	0.	0.
7	290.3	207.3	290.3	207.3	204.2	207.2	206.4	6.1	0.	0.
8	293.1	197.3	293.1	197.3	196.2	197.0	217.8	11.1	0.	0.
9	288.0	190.5	288.0	190.5	181.1	190.5	223.9	0.7	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.723	0.549	0.723	0.549	0.605	0.546	0.115	0,921	1,089
2	0.735	0.575	0.735	0.575	0.623	0.573	0.103	0,937	1,094
3	0.739	0.581	0.739	0.581	0.625	0.580	0.085	0,946	1,118
4	0.751	0.575	0.751	0.575	0.620	0.575	0.060	0,946	1,192
5	0.797	0.596	0.797	0.596	0.643	0.596	0.048	0,950	1,254
6	0.826	0.618	0.826	0.618	0.633	0.618	0.044	1,005	1,318
7	0.853	0.589	0.853	0.589	0.600	0.589	0.065	1,015	1,417
8	0.862	0.559	0.862	0.559	0.577	0.558	0.128	1,004	1,467
9	0.844	0.538	0.844	0.538	0.531	0.538	0.136	1,052	1,476

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	12.9	2.1	10.2	0.380	0.	0.202	0.202	0.065	0.065
2	10.00	11.0	1.9	9.3	0.349	0.	0.144	0.144	0.045	0.045
3	15.00	10.1	2.2	8.1	0.348	0.	0.109	0.109	0.034	0.034
4	30.00	8.2	2.8	5.9	0.377	0.	0.090	0.090	0.026	0.026
5	50.00	4.4	0.2	5.7	0.386	0.	0.069	0.069	0.018	0.018
6	70.00	2.3	-2.4	6.3	0.382	0.	0.032	0.031	0.008	0.007
7	85.00	1.2	-3.9	9.2	0.433	0.	0.109	0.103	0.024	0.022
8	90.00	0.7	-4.1	11.2	0.472	0.	0.182	0.171	0.038	0.036
9	95.00	0.4	-4.2	8.6	0.493	0.	0.201	0.190	0.041	0.039

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9C

(c) 100 Percent of design speed; reading 1333

RP	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	35.3	5.3	35.3	5.3	334.4	1.000	15.92	0.936
2	22.487	22.489	34.1	4.7	34.1	4.7	332.4	1.002	15.83	0.958
3	22.012	22.014	34.3	3.8	34.3	3.8	332.0	0.999	15.84	0.957
4	20.571	20.589	36.0	1.4	36.0	1.4	330.9	0.998	15.71	0.959
5	18.656	18.732	38.1	0.6	38.1	0.6	329.4	1.001	15.59	0.974
6	16.728	16.937	41.8	-0.2	41.8	-0.2	328.3	1.004	15.39	0.993
7	15.273	15.649	47.3	2.3	47.3	2.3	330.6	0.998	15.66	0.954
8	14.780	15.220	49.2	3.5	49.2	3.5	331.1	0.998	15.81	0.927
9	14.287	14.783	51.7	0.0	51.7	0.0	331.4	0.996	15.58	0.924

RP	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	250.6	195.1	250.6	195.1	204.5	194.2	144.9	18.2	0.	0.
2	251.3	201.2	251.3	201.2	208.2	200.5	140.7	16.6	0.	0.
3	253.7	200.0	253.7	200.0	209.7	199.6	142.9	13.3	0.	0.
4	255.2	193.7	255.2	193.7	206.3	193.7	150.1	4.7	0.	0.
5	265.8	201.0	265.8	201.0	209.0	201.0	164.2	2.1	0.	0.
6	271.0	206.9	271.0	206.9	202.1	206.9	180.7	-0.8	0.	0.
7	285.7	198.1	285.7	198.1	193.8	198.0	209.9	7.9	0.	0.
8	290.4	190.8	290.4	190.8	190.0	190.5	219.7	11.6	0.	0.
9	285.3	183.2	285.3	183.2	176.6	183.2	224.0	0.1	0.	0.

RP	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
	IN	OUT	IN	OUT	IN	OUT			
1	0.718	0.548	0.718	0.548	0.586	0.545	0.119	0.950	1.130
2	0.722	0.567	0.722	0.567	0.599	0.565	0.122	0.963	1.125
3	0.731	0.565	0.731	0.565	0.604	0.564	0.116	0.952	1.155
4	0.737	0.548	0.737	0.548	0.596	0.548	0.101	0.939	1.212
5	0.773	0.570	0.773	0.570	0.608	0.570	0.064	0.962	1.270
6	0.792	0.588	0.792	0.588	0.590	0.588	0.049	1.024	1.313
7	0.837	0.561	0.837	0.561	0.568	0.561	0.085	1.021	1.446
8	0.852	0.539	0.852	0.539	0.557	0.538	0.131	1.003	1.484
9	0.835	0.516	0.835	0.516	0.517	0.516	0.137	1.037	1.481

RP	PERCENT SPAN	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
		MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	14.9	4.2	9.9	0.385	0.	0.219	0.219	0.070	0.070
2	10.00	13.1	3.9	9.2	0.356	0.	0.144	0.144	0.046	0.046
3	15.00	12.1	4.3	8.2	0.370	0.	0.145	0.145	0.045	0.045
4	30.00	9.9	4.5	6.0	0.406	0.	0.136	0.136	0.039	0.039
5	50.00	6.4	2.2	6.1	0.404	0.	0.079	0.079	0.021	0.021
6	70.00	4.1	-0.6	6.2	0.394	0.	0.020	0.020	0.005	0.005
7	85.00	3.1	-1.9	9.8	0.458	0.	0.125	0.118	0.027	0.025
8	90.00	1.8	-2.9	11.4	0.491	0.	0.192	0.180	0.040	0.038
9	95.00	1.1	-3.4	8.4	0.514	0.	0.209	0.198	0.042	0.040

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TABLE XIV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9C

(d) 100 Percent of design speed; reading 1335

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	36.3	5.4	36.3	5.4	335.8	0.999	15.92	0.930
2	22.487	22.489	35.1	4.9	35.1	4.9	333.9	1.000	15.85	0.946
3	22.012	22.014	35.7	3.9	35.7	3.9	332.9	1.000	15.77	0.950
4	20.571	20.589	37.6	1.5	37.6	1.5	331.3	1.000	15.68	0.951
5	18.656	18.732	39.4	0.7	39.4	0.7	329.6	1.002	15.57	0.973
6	16.728	16.937	43.5	-0.3	43.5	-0.3	328.6	1.002	15.28	0.990
7	15.273	15.649	48.2	2.7	48.2	2.7	330.3	0.999	15.67	0.950
8	14.780	15.220	49.5	3.4	49.5	3.4	330.7	0.997	15.76	0.925
9	14.287	14.783	51.8	0.1	51.8	0.1	331.6	0.996	15.67	0.918

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	248.6	193.1	248.6	193.1	200.3	192.2	147.3	18.3	0.	0.
2	251.3	197.9	251.3	197.9	205.6	197.2	144.5	16.9	0.	0.
3	251.4	196.1	251.4	196.1	204.1	195.7	146.8	13.3	0.	0.
4	251.6	188.0	251.6	188.0	199.5	187.9	153.4	4.9	0.	0.
5	260.7	195.7	260.7	195.7	201.5	195.7	165.5	2.5	0.	0.
6	264.1	199.2	264.1	199.2	191.6	199.1	181.7	-1.0	0.	0.
7	283.2	194.0	283.2	194.0	188.8	193.8	211.2	9.0	0.	0.
8	288.7	187.4	288.7	187.4	187.6	187.1	219.4	11.2	0.	0.
9	286.8	183.4	286.8	183.4	177.5	183.4	225.3	0.4	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.710	0.541	0.710	0.541	0.572	0.539	0.137	0.960	1.142
2	0.721	0.557	0.721	0.557	0.590	0.555	0.141	0.959	1.148
3	0.722	0.552	0.722	0.552	0.587	0.551	0.135	0.959	1.177
4	0.725	0.530	0.725	0.530	0.575	0.529	0.122	0.942	1.230
5	0.756	0.553	0.756	0.553	0.585	0.553	0.076	0.971	1.275
6	0.768	0.565	0.768	0.565	0.558	0.565	0.055	1.039	1.318
7	0.829	0.549	0.829	0.549	0.553	0.548	0.097	1.027	1.459
8	0.847	0.529	0.847	0.529	0.550	0.528	0.131	0.997	1.484
9	0.839	0.517	0.839	0.517	0.519	0.517	0.141	1.033	1.490

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	15.9	5.2	10.0	0.391	0.	0.246	0.246	0.079	0.079
2	10.00	14.1	4.9	9.3	0.373	0.	0.184	0.184	0.058	0.058
3	15.00	13.6	5.7	8.3	0.384	0.	0.169	0.169	0.052	0.052
4	30.00	11.5	6.0	6.1	0.424	0.	0.165	0.165	0.048	0.048
5	50.00	7.6	3.5	6.2	0.414	0.	0.086	0.086	0.023	0.023
6	70.00	5.8	1.1	6.2	0.408	0.	0.032	0.031	0.008	0.007
7	85.00	4.1	-1.0	10.2	0.468	0.	0.139	0.131	0.030	0.028
8	90.00	2.1	-2.6	11.4	0.499	0.	0.200	0.189	0.042	0.040
9	95.00	1.1	-3.4	8.5	0.517	0.	0.221	0.209	0.045	0.042

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9C

(e) 90 Percent of design speed; reading 1326

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	23.9	5.3	23.9	5.3	316.2	0.998	13.10	0.950
2	22.487	22.489	23.1	4.6	23.1	4.6	315.6	0.999	13.26	0.967
3	22.012	22.014	23.5	2.7	23.5	2.7	315.6	0.999	13.37	0.981
4	20.571	20.589	25.7	0.3	25.7	0.3	316.2	0.999	13.68	0.983
5	18.656	18.732	29.4	-1.1	29.4	-1.1	317.8	0.999	13.93	0.984
6	16.728	16.937	34.5	-1.5	34.5	-1.5	319.8	1.001	14.21	0.989
7	15.273	15.649	40.7	0.2	40.7	0.2	322.5	1.000	14.54	0.981
8	14.780	15.220	43.6	1.9	43.6	1.9	323.7	0.998	14.67	0.945
9	14.287	14.783	47.1	1.8	47.1	1.8	324.4	0.997	14.58	0.925

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	225.2	180.6	225.2	180.6	206.0	179.8	91.2	16.6	0.	0.
2	231.3	194.4	231.3	194.4	212.8	193.8	90.7	15.6	0.	0.
3	235.1	203.5	235.1	203.5	215.7	203.3	93.7	9.5	0.	0.
4	245.1	212.7	245.1	212.7	220.8	212.7	106.3	1.1	0.	0.
5	260.1	222.3	260.1	222.3	226.6	222.3	127.6	-4.3	0.	0.
6	272.1	232.9	272.1	232.9	224.3	232.8	154.0	-5.9	0.	0.
7	282.2	238.0	282.2	238.0	214.0	238.0	184.0	0.9	0.	0.
8	285.1	227.2	285.1	227.2	206.4	227.1	196.6	7.5	0.	0.
9	281.1	216.8	281.1	216.8	191.3	216.7	206.0	7.0	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.659	0.520	0.659	0.520	0.602	0.518	0.108	0.873	0.765
2	0.679	0.563	0.679	0.563	0.625	0.561	0.098	0.910	0.788
3	0.691	0.591	0.691	0.591	0.634	0.591	0.060	0.943	0.827
4	0.723	0.619	0.723	0.619	0.651	0.619	0.036	0.963	0.932
5	0.770	0.648	0.770	0.648	0.671	0.648	0.032	0.981	1.034
6	0.807	0.679	0.807	0.679	0.665	0.678	0.033	1.038	1.137
7	0.837	0.692	0.837	0.692	0.635	0.692	0.040	1.112	1.259
8	0.845	0.657	0.845	0.657	0.612	0.657	0.098	1.101	1.313
9	0.831	0.624	0.831	0.624	0.565	0.624	0.136	1.133	1.343

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	3.5	-7.3	9.9	0.305	0.	0.199	0.199	0.064	0.064
2	10.00	2.1	-7.1	9.0	0.262	0.	0.125	0.125	0.039	0.039
3	15.00	1.4	-6.5	7.1	0.245	0.	0.071	0.071	0.022	0.022
4	30.00	-0.4	-5.8	4.9	0.257	0.	0.058	0.058	0.017	0.017
5	50.00	-2.4	-6.5	4.4	0.278	0.	0.048	0.048	0.013	0.013
6	70.00	-3.2	-7.9	5.0	0.282	0.	0.030	0.030	0.007	0.007
7	85.00	-3.5	-8.5	7.7	0.295	0.	0.053	0.053	0.011	0.011
8	90.00	-3.7	-8.5	9.8	0.340	0.	0.147	0.145	0.031	0.030
9	95.00	-3.6	-8.1	10.2	0.370	0.	0.206	0.204	0.042	0.041

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9C

(f) 90 Percent of design speed; reading 1327

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.957	22.959	32.7	5.1	32.7	5.1	323.7	0.999	14.38	0.955
2	22.487	22.489	31.3	4.7	31.3	4.7	322.5	1.000	14.43	0.966
3	22.012	22.014	31.8	3.4	31.8	3.4	322.2	0.999	14.39	0.976
4	20.571	20.589	33.4	1.0	33.4	1.0	321.3	0.999	14.39	0.976
5	18.656	18.732	36.0	0.2	36.0	0.2	320.1	1.002	14.22	0.988
6	16.728	16.937	40.3	-0.4	40.3	-0.4	320.6	1.002	14.25	0.991
7	15.273	15.649	45.6	1.5	45.6	1.5	322.8	0.999	14.56	0.970
8	14.780	15.220	47.8	3.3	47.8	3.3	323.7	0.997	14.77	0.940
9	14.287	14.783	50.4	0.5	50.4	0.5	323.9	0.998	14.58	0.937

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	225.1	178.5	225.1	178.5	189.4	177.8	121.6	15.8	0.	0.
2	228.6	184.8	228.6	184.8	195.3	184.2	118.8	15.0	0.	0.
3	228.4	187.5	228.4	187.5	194.2	187.2	120.3	11.2	0.	0.
4	231.7	183.9	231.7	183.9	193.4	183.9	127.7	3.1	0.	0.
5	236.7	188.5	236.7	188.5	191.4	188.5	139.3	0.7	0.	0.
6	244.8	193.0	244.8	193.0	186.6	193.0	158.5	-1.2	0.	0.
7	260.6	194.4	260.6	194.4	182.4	194.4	186.1	5.0	0.	0.
8	267.7	187.0	267.7	187.0	179.7	186.7	198.4	10.6	0.	0.
9	263.6	180.2	263.6	180.2	167.9	180.2	203.2	1.6	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.650	0.508	0.650	0.508	0.547	0.506	0.101	0.939	0.965
2	0.662	0.527	0.662	0.527	0.566	0.526	0.096	0.943	0.969
3	0.662	0.536	0.662	0.536	0.563	0.535	0.072	0.964	0.991
4	0.674	0.526	0.674	0.526	0.562	0.526	0.064	0.951	1.050
5	0.691	0.540	0.691	0.540	0.559	0.540	0.052	0.985	1.086
6	0.716	0.554	0.716	0.554	0.546	0.554	0.045	1.034	1.152
7	0.765	0.557	0.765	0.557	0.535	0.556	0.063	1.065	1.277
8	0.787	0.534	0.787	0.534	0.528	0.535	0.129	1.039	1.334
9	0.773	0.513	0.773	0.513	0.493	0.513	0.148	1.073	1.337

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	12.3	1.5	9.7	0.359	0.	0.184	0.184	0.059	0.059
2	10.00	10.3	1.1	9.1	0.335	0.	0.134	0.134	0.042	0.042
3	15.00	9.7	1.8	7.9	0.327	0.	0.093	0.093	0.029	0.029
4	30.00	7.4	1.9	5.6	0.362	0.	0.092	0.092	0.027	0.027
5	50.00	4.3	0.1	5.7	0.357	0.	0.042	0.042	0.011	0.011
6	70.00	2.7	-2.1	6.1	0.365	0.	0.032	0.032	0.008	0.008
7	85.00	1.4	-3.6	9.0	0.402	0.	0.092	0.092	0.020	0.020
8	90.00	0.5	-4.3	11.2	0.446	0.	0.179	0.179	0.038	0.037
9	95.00	-0.2	-4.7	8.9	0.469	0.	0.194	0.193	0.039	0.039

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9C

(g) 90 Percent of design speed; reading 1328

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	48.9	4.1	48.9	4.1	330.4	0.993	13.89	0.937
2	22.487	22.489	44.0	3.9	44.0	3.9	328.4	0.995	13.95	0.940
3	22.012	22.014	42.6	3.0	42.6	3.0	327.0	0.996	13.95	0.942
4	20.571	20.589	41.8	1.0	41.8	1.0	324.0	0.999	13.88	0.952
5	18.656	18.732	44.6	0.2	44.6	0.2	322.6	1.000	13.87	0.965
6	16.728	16.937	44.9	0.5	44.9	0.5	321.8	0.999	14.22	0.967
7	15.273	15.649	48.2	2.8	48.2	2.8	323.3	0.998	14.62	0.958
8	14.780	15.220	49.5	3.7	49.5	3.7	324.0	0.996	14.86	0.933
9	14.287	14.783	51.4	0.8	51.4	0.8	323.9	0.998	14.72	0.932

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	207.1	154.2	207.1	154.2	136.1	153.8	156.1	11.1	0.	0.
2	210.0	157.3	210.0	157.3	151.2	157.0	145.7	10.6	0.	0.
3	211.0	156.5	211.0	156.5	155.3	156.3	142.8	8.3	0.	0.
4	211.9	154.2	211.9	154.2	158.1	154.2	141.2	2.6	0.	0.
5	217.4	161.0	217.4	161.0	154.9	161.0	152.5	0.5	0.	0.
6	235.0	171.6	235.0	171.6	166.6	171.6	165.7	1.6	0.	0.
7	255.3	182.3	255.3	182.3	170.3	182.1	190.2	8.8	0.	0.
8	264.1	178.8	264.1	178.8	171.4	178.4	201.0	11.5	0.	0.
9	261.4	175.6	261.4	175.6	163.0	175.6	204.4	2.4	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.588	0.432	0.588	0.432	0.386	0.431	0.131	1.130	1.203
2	0.598	0.443	0.598	0.443	0.431	0.442	0.131	1.038	1.135
3	0.603	0.441	0.603	0.441	0.444	0.440	0.130	1.006	1.124
4	0.609	0.436	0.609	0.436	0.454	0.436	0.099	0.975	1.121
5	0.627	0.456	0.627	0.456	0.447	0.456	0.085	1.039	1.168
6	0.683	0.489	0.683	0.489	0.484	0.489	0.074	1.030	1.204
7	0.747	0.520	0.747	0.520	0.498	0.519	0.091	1.069	1.313
8	0.775	0.509	0.775	0.509	0.503	0.508	0.126	1.041	1.359
9	0.766	0.499	0.766	0.499	0.478	0.499	0.140	1.077	1.351

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	28.5	17.8	8.7	0.482	0.	0.304	0.304	0.098	0.098
2	10.00	23.0	13.8	8.3	0.454	0.	0.279	0.279	0.088	0.088
3	15.00	20.5	12.6	7.5	0.456	0.	0.267	0.267	0.083	0.083
4	30.00	15.7	10.2	5.6	0.462	0.	0.218	0.218	0.063	0.063
5	50.00	12.8	8.6	5.7	0.443	0.	0.149	0.149	0.039	0.039
6	70.00	7.2	2.4	7.0	0.434	0.	0.121	0.121	0.029	0.029
7	85.00	4.0	-1.1	10.3	0.438	0.	0.136	0.136	0.030	0.029
8	90.00	2.2	-2.5	11.6	0.471	0.	0.206	0.205	0.043	0.043
9	95.00	0.8	-3.8	9.2	0.482	0.	0.211	0.210	0.043	0.043

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TABLE XIV. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR STATOR 9C

(h) 80 Percent of design speed; reading 1325

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	52.3	3.3	52.3	3.3	322.3	0.994	12.98	0.939
2	22.487	22.489	45.7	2.8	45.7	2.8	320.2	0.999	13.08	0.933
3	22.012	22.014	43.7	2.2	43.7	2.2	318.6	1.001	13.08	0.934
4	20.571	20.589	48.2	1.0	48.2	1.0	317.0	1.001	12.91	0.950
5	18.656	18.732	51.4	0.1	51.4	0.1	316.2	1.000	12.89	0.966
6	16.728	16.937	47.5	1.8	47.5	1.8	315.2	1.000	13.21	0.968
7	15.273	15.649	48.5	3.1	48.5	3.1	316.0	0.999	13.57	0.967
8	14.780	15.220	49.4	3.5	49.4	3.5	316.0	0.999	13.71	0.949
9	14.287	14.783	51.2	0.7	51.2	0.7	316.1	0.999	13.73	0.941

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	174.8	121.4	174.8	121.4	106.9	121.2	138.4	7.0	0.	0.
2	179.2	121.2	179.2	121.2	125.3	121.0	128.2	5.9	0.	0.
3	180.2	120.4	180.2	120.4	130.3	120.3	124.4	4.6	0.	0.
4	176.2	119.3	176.2	119.3	117.4	119.3	131.4	2.1	0.	0.
5	182.7	129.4	182.7	129.4	114.1	129.4	142.7	0.3	0.	0.
6	202.8	147.7	202.8	147.7	137.0	147.7	149.5	4.7	0.	0.
7	222.9	164.0	222.9	164.0	147.8	163.8	166.8	8.8	0.	0.
8	229.7	160.4	229.7	160.4	149.5	160.1	174.4	9.9	0.	0.
9	231.1	158.5	231.1	158.5	144.9	158.5	180.0	1.8	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.498	0.342	0.498	0.342	0.304	0.342	0.171	1,134	1,082
2	0.513	0.342	0.513	0.342	0.358	0.342	0.167	0.966	1,003
3	0.517	0.340	0.517	0.340	0.374	0.340	0.155	0.923	0.983
4	0.506	0.338	0.506	0.338	0.337	0.338	0.163	1,016	1,050
5	0.527	0.368	0.527	0.368	0.329	0.368	0.140	1,134	1,111
6	0.589	0.422	0.589	0.422	0.398	0.422	0.122	1,078	1,093
7	0.652	0.471	0.652	0.471	0.432	0.470	0.117	1,108	1,152
8	0.673	0.460	0.673	0.460	0.438	0.459	0.144	1,071	1,178
9	0.677	0.454	0.677	0.454	0.425	0.454	0.152	1,094	1,189

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	31.9	21.2	7.9	0.548	0.	0.395	0.395	0.127	0.127
2	10.00	24.7	15.5	7.2	0.540	0.	0.411	0.411	0.130	0.130
3	15.00	21.5	13.7	6.6	0.538	0.	0.399	0.399	0.123	0.123
4	30.00	22.1	16.7	5.6	0.535	0.	0.311	0.311	0.090	0.090
5	50.00	19.6	15.4	5.6	0.496	0.	0.200	0.200	0.053	0.053
6	70.00	9.9	5.1	8.3	0.439	0.	0.154	0.154	0.036	0.036
7	85.00	4.3	-0.8	10.6	0.415	0.	0.131	0.131	0.028	0.028
8	90.00	2.1	-2.7	11.5	0.449	0.	0.196	0.196	0.041	0.041
9	95.00	0.5	-4.0	9.1	0.468	0.	0.221	0.221	0.045	0.045

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9C

(i) 70 Percent of design speed; reading 1323

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	14.9	2.5	14.9	2.5	300.3	1.000	11.36	0.966
2	22.487	22.489	15.4	0.5	15.4	0.5	300.2	1.000	11.45	0.982
3	22.012	22.014	15.9	-1.1	15.9	-1.1	300.4	0.999	11.51	0.990
4	20.571	20.589	18.5	-2.7	18.5	-2.7	301.8	0.999	11.74	0.990
5	18.656	18.732	23.6	-3.0	23.6	-3.0	303.9	1.000	12.06	0.988
6	16.728	16.937	29.9	-2.6	29.9	-2.6	306.4	1.000	12.41	0.986
7	15.273	15.649	36.4	-1.0	36.4	-1.0	309.1	1.001	12.72	0.986
8	14.780	15.220	39.4	0.5	39.4	0.5	310.1	1.000	12.86	0.972
9	14.287	14.783	42.3	1.5	42.3	1.5	310.7	1.000	12.90	0.938

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	186.0	157.3	186.0	157.3	179.8	157.2	47.7	6.8	0.	0.
2	190.1	167.5	190.1	167.5	183.2	167.5	50.6	1.3	0.	0.
3	191.9	172.8	191.9	172.8	184.5	172.8	52.6	-3.4	0.	0.
4	198.9	179.7	198.9	179.7	188.7	179.5	63.0	-8.3	0.	0.
5	213.6	200.7	213.6	200.7	195.8	200.5	85.4	-10.4	0.	0.
6	227.9	213.5	227.9	213.5	197.7	213.2	113.5	-9.8	0.	0.
7	239.5	226.1	239.5	226.1	192.7	226.0	142.3	-4.0	0.	0.
8	243.2	225.7	243.2	225.7	188.0	225.7	154.2	1.9	0.	0.
9	242.6	214.7	242.6	214.7	179.4	214.7	163.3	5.6	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.552	0.462	0.552	0.462	0.533	0.462	0.109	0.874	0.552
2	0.564	0.494	0.564	0.494	0.544	0.494	0.074	0.914	0.564
3	0.570	0.510	0.570	0.510	0.548	0.510	0.036	0.936	0.570
4	0.591	0.531	0.591	0.531	0.561	0.530	0.030	0.951	0.591
5	0.635	0.594	0.635	0.594	0.582	0.594	0.029	1.024	0.706
6	0.679	0.632	0.679	0.632	0.589	0.631	0.044	1.079	0.844
7	0.713	0.669	0.713	0.669	0.574	0.669	0.037	1.173	0.969
8	0.724	0.667	0.724	0.667	0.560	0.667	0.062	1.201	1.020
9	0.722	0.631	0.722	0.631	0.534	0.631	0.135	1.196	1.049

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	-5.6	-16.3	7.1	0.225	0.	0.180	0.180	0.058	0.058
2	10.00	-5.6	-14.7	4.9	0.201	0.	0.092	0.092	0.029	0.029
3	15.00	-6.2	-14.1	3.3	0.190	0.	0.051	0.051	0.016	0.016
4	30.00	-7.6	-13.1	2.0	0.201	0.	0.050	0.050	0.014	0.014
5	50.00	-8.2	-12.3	2.5	0.178	0.	0.050	0.050	0.013	0.013
6	70.00	-7.8	-12.6	3.8	0.191	0.	0.054	0.054	0.013	0.013
7	85.00	-7.7	-12.8	6.5	0.187	0.	0.048	0.048	0.010	0.010
8	90.00	-8.0	-12.7	8.4	0.201	0.	0.094	0.094	0.020	0.020
9	95.00	-8.4	-12.9	9.9	0.244	0.	0.212	0.212	0.043	0.043

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR STATOR 9C

(j) 70 Percent of design speed; reading 1320

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	29.5	4.3	29.5	4.8	307.4	1.000	12.30	0.970
2	22.487	22.489	28.5	4.4	28.5	4.4	306.6	1.000	12.30	0.982
3	22.012	22.014	28.4	2.6	28.4	2.6	306.6	0.999	12.29	0.988
4	20.571	20.589	31.1	0.4	31.1	0.4	306.2	1.000	12.31	0.990
5	18.656	18.732	34.5	-0.3	34.5	-0.3	306.6	0.999	12.36	0.990
6	16.728	16.937	38.9	-0.5	38.9	-0.5	307.4	1.000	12.47	0.991
7	15.273	15.649	44.0	0.6	44.0	0.6	308.7	0.999	12.64	0.985
8	14.780	15.220	46.2	2.9	46.2	2.9	309.2	0.999	12.79	0.965
9	14.287	14.783	48.5	1.2	48.5	1.2	309.4	1.000	12.67	0.965

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	171.3	137.1	171.3	137.1	149.0	136.6	84.4	11.5	0.	0.
2	172.4	144.1	172.4	144.1	151.5	143.7	82.2	11.0	0.	0.
3	172.4	146.2	172.4	146.2	151.6	146.1	82.1	6.7	0.	0.
4	173.5	146.0	173.5	146.0	148.6	146.0	89.5	0.9	0.	0.
5	181.0	150.5	181.0	150.5	149.2	150.5	102.4	-0.8	0.	0.
6	190.4	157.4	190.4	157.4	148.2	157.4	119.5	-1.4	0.	0.
7	201.4	161.8	201.4	161.8	145.0	161.8	139.8	1.7	0.	0.
8	208.0	157.1	208.0	157.1	144.0	156.9	150.0	7.8	0.	0.
9	205.1	153.8	205.1	153.8	135.8	153.7	153.8	3.2	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.499	0.396	0.499	0.396	0.434	0.395	0.093	0.917	0.687
2	0.503	0.417	0.503	0.417	0.442	0.416	0.074	0.948	0.688
3	0.503	0.424	0.503	0.424	0.443	0.424	0.053	0.964	0.695
4	0.507	0.424	0.507	0.424	0.435	0.424	0.042	0.982	0.749
5	0.530	0.437	0.530	0.437	0.437	0.437	0.039	1.009	0.804
6	0.558	0.457	0.558	0.457	0.435	0.457	0.046	1.062	0.871
7	0.592	0.470	0.592	0.470	0.426	0.470	0.044	1.116	0.955
8	0.612	0.455	0.612	0.455	0.424	0.455	0.118	1.089	1.003
9	0.603	0.445	0.603	0.445	0.399	0.445	0.148	1.132	1.003

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	9.1	-1.6	9.4	0.337	0.	0.192	0.192	0.062	0.062
2	10.00	7.5	-1.7	8.8	0.295	0.	0.112	0.112	0.035	0.035
3	15.00	6.3	-1.6	7.0	0.287	0.	0.076	0.076	0.024	0.024
4	30.00	5.0	-0.5	5.0	0.306	0.	0.062	0.062	0.018	0.018
5	50.00	2.7	-1.5	5.2	0.318	0.	0.057	0.057	0.015	0.015
6	70.00	1.2	-3.5	6.0	0.322	0.	0.045	0.045	0.011	0.011
7	85.00	-0.2	-5.3	8.1	0.343	0.	0.070	0.070	0.015	0.015
8	90.00	-1.2	-5.9	10.8	0.386	0.	0.159	0.159	0.033	0.033
9	95.00	-2.1	-6.6	9.6	0.397	0.	0.159	0.159	0.032	0.032

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR STATOR 9C

(k) 70 Percent of design speed; reading 1321

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	52.3	3.1	52.3	3.1	313.9	0.995	12.28	0.951
2	22.487	22.489	45.8	2.6	45.8	2.6	312.3	0.999	12.33	0.949
3	22.012	22.014	43.5	2.0	43.5	2.0	311.2	1.001	12.34	0.949
4	20.571	20.589	48.2	0.9	48.2	0.9	310.0	1.001	12.22	0.962
5	18.656	18.732	51.6	0.2	51.6	0.2	309.4	1.000	12.19	0.975
6	16.728	16.937	48.5	1.8	48.5	1.8	309.1	1.000	12.44	0.977
7	15.273	15.649	48.7	3.3	48.7	3.3	309.7	0.998	12.74	0.968
8	14.780	15.220	49.2	3.7	49.2	3.7	309.4	0.998	12.83	0.955
9	14.287	14.783	51.2	0.6	51.2	0.6	309.4	0.999	12.74	0.958

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	151.7	105.0	151.7	105.0	92.8	104.9	119.9	5.7	0.	0.
2	154.5	105.9	154.5	105.9	107.8	105.7	110.7	4.9	0.	0.
3	155.6	104.8	155.6	104.8	112.8	104.7	107.1	3.7	0.	0.
4	152.4	104.0	152.4	104.0	101.6	103.9	113.6	1.7	0.	0.
5	157.7	113.2	157.7	113.2	98.0	113.2	123.5	0.4	0.	0.
6	175.8	129.7	175.8	129.7	116.6	129.6	131.6	4.0	0.	0.
7	194.9	140.4	194.9	140.4	128.6	140.2	146.4	8.0	0.	0.
8	200.0	137.3	200.0	137.3	130.6	137.0	151.5	8.9	0.	0.
9	198.5	136.7	198.5	136.7	124.4	136.7	154.7	1.3	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.435	0.299	0.435	0.299	0.266	0.299	0.173	1.130	0.945
2	0.445	0.302	0.445	0.302	0.310	0.301	0.162	0.981	0.872
3	0.449	0.299	0.449	0.299	0.325	0.299	0.173	0.928	0.851
4	0.440	0.297	0.440	0.297	0.293	0.297	0.158	1.023	0.912
5	0.456	0.324	0.456	0.324	0.284	0.324	0.142	1.155	0.967
6	0.512	0.373	0.512	0.373	0.339	0.373	0.117	1.112	0.966
7	0.570	0.405	0.570	0.405	0.376	0.404	0.115	1.090	1.013
8	0.586	0.396	0.586	0.396	0.383	0.395	0.143	1.049	1.023
9	0.582	0.394	0.582	0.394	0.365	0.394	0.145	1.099	1.022

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	31.8	21.1	7.7	0.551	0.	0.401	0.401	0.129	0.129
2	10.00	24.8	15.6	7.1	0.532	0.	0.399	0.399	0.126	0.126
3	15.00	21.4	13.5	6.5	0.532	0.	0.394	0.394	0.122	0.122
4	30.00	22.1	16.7	5.6	0.530	0.	0.303	0.303	0.088	0.088
5	50.00	19.8	15.7	5.7	0.487	0.	0.188	0.188	0.049	0.049
6	70.00	10.8	6.0	8.2	0.433	0.	0.141	0.141	0.033	0.033
7	85.00	4.5	-0.5	10.8	0.431	0.	0.161	0.161	0.035	0.035
8	90.00	1.9	-2.8	11.6	0.460	0.	0.218	0.218	0.046	0.046
9	95.00	0.5	-4.0	9.0	0.465	0.	0.203	0.203	0.041	0.041

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TABLE XIV. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9C

(ℓ) 60 Percent of design speed; reading 1318

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.957	22.959	51.2	3.2	51.2	3.2	307.0	0.997	11.71	0.965
2	22.487	22.489	44.9	2.7	44.9	2.7	306.0	0.999	11.75	0.963
3	22.012	22.014	43.2	2.1	43.2	2.1	305.1	1.001	11.74	0.964
4	20.571	20.589	47.8	1.2	47.8	1.2	304.4	1.000	11.68	0.972
5	18.656	18.732	50.9	0.5	50.9	0.5	304.1	1.000	11.67	0.981
6	16.728	16.937	47.9	2.1	47.9	2.1	303.1	1.001	11.78	0.987
7	15.273	15.649	48.4	3.5	48.4	3.5	303.6	1.000	11.98	0.980
8	14.780	15.220	49.3	3.9	49.3	3.9	303.8	0.999	12.05	0.971
9	14.287	14.783	50.9	0.6	50.9	0.6	304.0	0.999	12.01	0.971

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	129.7	92.1	129.7	92.1	81.3	92.0	101.0	5.1	0.	0.
2	132.6	92.7	132.6	92.7	93.8	92.5	93.7	4.4	0.	0.
3	133.0	92.1	133.0	92.1	97.0	92.0	91.0	3.4	0.	0.
4	131.6	90.6	131.6	90.6	88.4	90.6	97.5	1.9	0.	0.
5	136.6	98.2	136.6	98.2	86.1	98.2	106.1	0.9	0.	0.
6	148.8	112.0	148.8	112.0	99.7	111.9	110.5	4.1	0.	0.
7	164.7	120.2	164.7	120.2	109.3	120.0	123.3	7.3	0.	0.
8	169.6	118.1	169.6	118.1	110.6	117.9	128.7	7.9	0.	0.
9	169.5	117.0	169.5	117.0	106.9	117.0	131.6	1.2	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.374	0.264	0.374	0.264	0.235	0.264	0.173	1.131	0.798
2	0.384	0.266	0.384	0.266	0.272	0.266	0.164	0.986	0.741
3	0.385	0.265	0.385	0.265	0.281	0.264	0.169	0.948	0.727
4	0.382	0.261	0.382	0.261	0.256	0.261	0.160	1.025	0.786
5	0.397	0.283	0.397	0.283	0.250	0.283	0.149	1.141	0.831
6	0.434	0.324	0.434	0.324	0.291	0.324	0.120	1.123	0.812
7	0.482	0.348	0.482	0.348	0.320	0.348	0.117	1.098	0.853
8	0.497	0.342	0.497	0.342	0.324	0.341	0.147	1.066	0.869
9	0.497	0.339	0.497	0.339	0.313	0.339	0.148	1.094	0.867

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	30.8	20.0	7.8	0.529	0.	0.384	0.384	0.124	0.124
2	10.00	23.9	14.8	7.1	0.514	0.	0.387	0.387	0.122	0.122
3	15.00	21.1	13.2	6.6	0.512	0.	0.369	0.369	0.114	0.114
4	30.00	21.7	16.3	5.8	0.522	0.	0.291	0.291	0.084	0.084
5	50.00	19.2	15.0	6.0	0.483	0.	0.186	0.186	0.049	0.049
6	70.00	10.3	5.5	8.6	0.415	0.	0.105	0.105	0.025	0.025
7	85.00	4.3	-0.8	11.0	0.420	0.	0.134	0.134	0.029	0.029
8	90.00	2.0	-2.7	11.8	0.450	0.	0.187	0.187	0.039	0.039
9	95.00	0.2	-4.3	9.0	0.463	0.	0.186	0.186	0.038	0.038

TABLE XV. - BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(a) 100 Percent of design speed; reading 3160

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	30.2	5.6	30.2	5.6	325.9	1.000	15.87	0.963
2	22.484	22.504	28.6	5.0	28.6	5.0	325.6	1.000	14.80	0.951
3	22.004	22.027	28.6	2.8	28.6	2.8	325.6	1.000	14.86	0.966
4	20.559	20.587	31.4	-0.8	31.4	-0.8	326.1	1.001	15.12	0.981
5	18.639	18.702	34.7	0.2	34.7	0.2	326.1	1.001	15.37	0.965
6	16.723	16.883	39.1	0.8	39.1	0.8	327.0	1.002	15.57	0.939
7	15.286	15.585	42.4	0.9	42.4	0.9	329.3	1.000	15.85	0.916
8	14.803	15.174	44.0	2.4	44.0	2.4	330.2	0.997	15.90	0.898
9	14.318	14.773	48.1	2.3	48.1	2.3	330.3	0.996	15.05	0.925

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	223.7	195.9	223.7	195.9	193.3	195.0	112.6	19.0	0.	0.
2	245.4	213.9	245.4	213.9	215.5	213.1	117.4	18.8	0.	0.
3	253.3	228.1	253.3	228.1	222.4	227.8	121.3	11.1	0.	0.
4	264.2	243.7	264.2	243.7	225.6	243.7	137.6	-3.3	0.	0.
5	274.9	248.3	274.9	248.3	225.9	248.3	156.7	0.7	0.	0.
6	287.0	247.8	287.0	247.8	222.8	247.8	181.0	3.3	0.	0.
7	304.7	252.5	304.7	252.5	224.8	252.5	205.6	3.9	0.	0.
8	310.9	251.5	310.9	251.5	223.8	251.2	215.8	10.4	0.	0.
9	292.9	247.9	292.9	247.9	195.5	247.7	218.0	9.9	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		**TOTAL LOSS COEFF, WAKE**	MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT			
1	0.643	0.558	0.643	0.558	0.556	0.555	0.166	1.009	0.785
2	0.712	0.613	0.712	0.613	0.625	0.611	0.156	0.989	0.834
3	0.737	0.657	0.737	0.657	0.647	0.656	0.110	1.024	0.872
4	0.772	0.706	0.772	0.706	0.659	0.706	0.066	1.080	0.969
5	0.807	0.720	0.807	0.720	0.663	0.720	0.112	1.099	1.022
6	0.847	0.717	0.847	0.717	0.657	0.717	0.164	1.112	1.069
7	0.903	0.730	0.903	0.730	0.667	0.730	0.161	1.123	1.094
8	0.924	0.727	0.924	0.727	0.665	0.726	0.171	1.123	1.096
9	0.862	0.716	0.862	0.716	0.575	0.716	0.184	1.267	1.080

	PFRCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	-3.8	-10.6	14.5	0.259	0.	0.151	0.151	0.049	0.049
2	10.00	-3.8	-10.3	13.3	0.255	0.	0.171	0.171	0.054	0.054
3	15.00	-2.8	-9.1	10.5	0.234	0.	0.113	0.113	0.035	0.035
4	30.00	-0.3	-5.9	6.8	0.232	0.	0.060	0.060	0.017	0.017
5	50.00	0.7	-3.8	8.2	0.245	0.	0.102	0.102	0.027	0.027
6	70.00	1.0	-2.4	9.5	0.282	0.	0.162	0.162	0.038	0.038
7	85.00	-0.4	-3.0	10.5	0.313	0.	0.200	0.200	0.043	0.043
8	90.00	-1.2	-3.6	12.4	0.328	0.	0.240	0.240	0.050	0.050
9	95.00	0.3	-1.9	12.9	0.295	0.	0.196	0.196	0.040	0.040

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(b) 100 Percent of design speed; reading 3188

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.959	22.969	30.4	4.6	30.4	4.6	326.4	0.999	13.98	0.968
2	22.484	22.504	28.5	4.8	28.5	4.8	326.1	0.999	14.69	0.954
3	22.004	22.027	28.8	3.2	28.8	3.2	326.1	0.999	14.94	0.968
4	20.559	20.587	31.4	-0.1	31.4	-0.1	326.1	1.001	15.10	0.992
5	18.639	18.702	34.8	0.1	34.8	0.1	326.3	1.001	15.38	0.986
6	16.723	16.883	38.9	0.1	38.9	0.1	327.0	1.002	15.57	0.967
7	15.286	15.585	42.4	1.9	42.4	1.9	329.2	0.999	15.77	0.947
8	14.803	15.174	44.1	3.9	44.1	3.9	330.2	0.996	15.83	0.915
9	14.318	14.773	48.4	3.4	48.4	3.4	330.2	0.995	15.04	0.931

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	222.2	183.3	222.2	183.3	191.6	182.7	112.5	14.8	0.	0.
2	244.0	200.3	244.0	200.3	214.4	199.6	116.5	16.7	0.	0.
3	252.1	214.4	252.1	214.4	221.0	214.0	121.3	11.8	0.	0.
4	261.6	230.8	261.6	230.8	223.4	230.8	136.1	-0.6	0.	0.
5	273.7	238.8	273.7	238.8	224.7	238.8	156.2	0.2	0.	0.
6	286.7	241.1	286.7	241.1	223.3	241.1	179.9	0.4	0.	0.
7	300.9	243.0	300.9	243.0	222.1	242.9	203.0	8.1	0.	0.
8	307.9	235.9	307.9	235.9	221.0	235.3	214.4	16.2	0.	0.
9	290.4	227.1	290.4	227.1	192.8	226.7	217.1	13.5	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.638	0.520	0.638	0.520	0.550	0.518	0.136	0.955	0.764
2	0.707	0.571	0.707	0.571	0.621	0.569	0.128	0.931	0.826
3	0.733	0.614	0.733	0.614	0.643	0.613	0.088	0.968	0.871
4	0.764	0.665	0.764	0.665	0.652	0.665	0.038	1.033	0.958
5	0.803	0.690	0.803	0.690	0.659	0.690	0.060	1.063	1.019
6	0.846	0.696	0.846	0.696	0.659	0.696	0.109	1.080	1.061
7	0.890	0.701	0.890	0.701	0.657	0.700	0.124	1.094	1.078
8	0.913	0.678	0.913	0.678	0.655	0.676	0.170	1.065	1.090
9	0.853	0.651	0.853	0.651	0.567	0.650	0.179	1.176	1.079

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-3.6	-10.4	13.6	0.317	0.	0.132	0.132	0.043	0.043
2	10.00	-3.8	-10.4	13.0	0.308	0.	0.163	0.163	0.051	0.051
3	15.00	-2.6	-8.9	10.9	0.204	0.	0.107	0.107	0.035	0.035
4	30.00	-0.3	-5.9	7.4	0.269	0.	0.024	0.024	0.007	0.007
5	50.00	0.8	-3.7	8.1	0.277	0.	0.042	0.042	0.011	0.011
6	70.00	0.8	-2.6	8.9	0.306	0.	0.089	0.089	0.021	0.021
7	85.00	-0.4	-3.0	11.5	0.331	0.	0.131	0.131	0.028	0.028
8	90.00	-1.0	-3.4	14.0	0.367	0.	0.205	0.205	0.043	0.043
9	95.00	0.5	-1.6	14.0	0.358	0.	0.183	0.183	0.037	0.037

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(c) 100 Percent of design speed; reading 3161

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	32.7	4.4	32.7	4.4	329.5	0.999	14.61	0.966
2	22.484	22.504	30.5	5.2	30.5	5.2	328.2	1.000	15.09	0.957
3	22.004	22.027	30.3	3.7	30.3	3.7	327.2	1.001	15.20	0.975
4	20.559	20.587	32.1	0.8	32.1	0.8	327.1	1.000	15.33	0.986
5	18.639	18.702	35.5	0.5	35.5	0.5	326.6	1.001	15.43	0.993
6	16.723	16.883	39.1	0.1	39.1	0.1	327.1	1.002	15.54	0.996
7	15.286	15.565	42.5	3.3	42.5	3.3	329.2	0.998	15.74	0.958
8	14.803	15.174	44.3	4.5	44.3	4.5	330.1	0.996	15.83	0.924
9	14.318	14.773	48.4	2.6	48.4	2.6	330.6	0.994	15.22	0.930

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	226.7	175.4	226.7	175.4	190.8	174.8	122.4	13.4	0.	0.
2	243.5	189.3	243.5	189.3	209.7	188.5	123.7	17.1	0.	0.
3	249.7	203.0	249.7	203.0	215.7	202.6	125.9	13.0	0.	0.
4	260.4	215.9	260.4	215.9	220.5	215.8	138.5	2.8	0.	0.
5	270.7	225.0	270.7	225.0	220.5	225.0	157.1	1.8	0.	0.
6	281.7	234.0	281.7	234.0	218.7	234.0	177.5	0.4	0.	0.
7	295.1	227.7	295.1	227.7	217.7	227.5	199.3	13.2	0.	0.
8	300.1	218.8	300.1	218.8	214.9	218.2	209.5	17.3	0.	0.
9	287.7	208.8	287.7	206.8	191.0	208.6	215.2	9.3	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT			
1	0.649	0.494	0.649	0.494	0.546	0.492	0.117	0.917	0.852
2	0.703	0.536	0.703	0.536	0.605	0.534	0.117	0.899	0.879
3	0.724	0.578	0.724	0.578	0.625	0.577	0.078	0.959	0.904
4	0.759	0.618	0.759	0.618	0.642	0.618	0.034	0.979	0.974
5	0.793	0.646	0.793	0.646	0.646	0.646	0.045	1.020	1.026
6	0.829	0.673	0.829	0.673	0.643	0.673	0.048	1.070	1.046
7	0.871	0.653	0.871	0.653	0.642	0.652	0.100	1.044	1.056
8	0.886	0.625	0.886	0.625	0.635	0.623	0.138	1.015	1.063
9	0.844	0.595	0.844	0.595	0.560	0.594	0.148	1.093	1.067

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	-1.4	-8.1	13.3	0.382	0.	0.139	0.139	0.045	0.045
2	10.00	-1.8	-8.3	13.4	0.361	0.	0.153	0.153	0.048	0.048
3	15.00	-1.1	-7.4	11.5	0.327	0.	0.085	0.085	0.026	0.026
4	30.00	0.4	-5.1	8.3	0.322	0.	0.039	0.039	0.011	0.011
5	50.00	1.5	-3.1	8.5	0.319	0.	0.021	0.021	0.006	0.006
6	70.00	1.0	-2.4	8.9	0.317	0.	0.010	0.010	0.002	0.002
7	85.00	-0.3	-3.0	13.0	0.363	0.	0.107	0.107	0.023	0.023
8	90.00	-0.8	-3.3	14.6	0.403	0.	0.190	0.190	0.040	0.040
9	95.00	0.5	-1.6	13.1	0.417	0.	0.188	0.188	0.038	0.038

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TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(d) 100 Percent of design speed; reading 3187

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.959	22.969	33.9	4.3	33.9	4.3	331.3	0.998	14.93	0.963
2	22.484	22.504	31.5	4.9	31.5	4.9	329.4	0.999	15.35	0.957
3	22.004	22.027	30.5	3.9	30.5	3.9	328.2	1.000	15.36	0.976
4	20.559	20.587	32.8	0.9	32.8	0.9	327.3	1.000	15.37	0.991
5	18.639	18.702	35.6	0.4	35.6	0.4	326.7	1.001	15.47	0.993
6	16.723	16.883	39.1	0.0	39.1	0.0	327.0	1.002	15.51	0.999
7	15.286	15.585	42.6	3.4	42.6	3.4	329.1	0.998	15.76	0.958
8	14.803	15.174	44.4	4.7	44.4	4.7	330.2	0.996	15.86	0.924
9	14.318	14.773	48.6	2.7	48.6	2.7	330.4	0.994	15.17	0.935

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	229.2	175.9	229.2	175.9	190.2	175.4	127.9	13.2	0.	0.
2	244.8	188.2	244.8	188.2	208.7	187.5	128.0	16.1	0.	0.
3	248.6	200.1	248.6	200.1	214.3	199.6	126.0	13.5	0.	0.
4	259.0	213.3	259.0	213.3	217.8	213.2	140.3	3.4	0.	0.
5	270.1	222.7	270.1	222.7	219.7	222.7	157.1	1.5	0.	0.
6	279.8	231.7	279.8	231.7	217.0	231.7	176.6	0.1	0.	0.
7	294.6	225.3	294.6	225.3	216.7	224.9	199.5	13.2	0.	0.
8	300.9	216.5	300.9	216.5	215.0	215.8	210.4	17.8	0.	0.
9	285.3	206.2	285.3	206.2	188.6	206.0	214.1	9.8	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.655	0.494	0.655	0.494	0.543	0.493	0.106	0.922	0.889
2	0.706	0.532	0.706	0.532	0.602	0.530	0.103	0.898	0.908
3	0.719	0.568	0.719	0.568	0.620	0.567	0.062	0.932	0.902
4	0.754	0.609	0.754	0.609	0.634	0.609	0.033	0.979	0.986
5	0.791	0.639	0.791	0.639	0.643	0.639	0.041	1.013	1.025
6	0.822	0.666	0.822	0.666	0.638	0.666	0.046	1.068	1.041
7	0.869	0.646	0.869	0.646	0.640	0.644	0.107	1.038	1.059
8	0.889	0.618	0.889	0.618	0.635	0.616	0.148	1.004	1.070
9	0.836	0.587	0.836	0.587	0.552	0.586	0.160	1.092	1.064

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-0.1	-6.8	13.3	0.394	0.	0.147	0.147	0.047	0.047
2	10.00	-0.8	-7.4	13.2	0.376	0.	0.153	0.153	0.048	0.048
3	15.00	-0.9	-7.2	11.7	0.335	0.	0.081	0.081	0.025	0.025
4	30.00	1.1	-4.5	6.5	0.330	0.	0.030	0.030	0.009	0.009
5	50.00	1.6	-3.0	8.4	0.327	0.	0.021	0.021	0.006	0.006
6	70.00	1.1	-2.3	8.6	0.320	0.	0.002	0.002	0.000	0.000
7	85.00	-0.2	-2.9	13.0	0.370	0.	0.108	0.108	0.023	0.023
8	90.00	-0.7	-3.1	14.6	0.413	0.	0.188	0.188	0.039	0.039
9	95.00	0.8	-1.4	13.3	0.420	0.	0.176	0.176	0.036	0.036

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(e) 100 Percent of design speed; reading 3162

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	36.2	5.0	36.2	5.0	334.1	0.999	15.19	0.959
2	22.484	22.504	33.7	5.7	33.7	5.7	332.4	0.999	15.37	0.958
3	22.004	22.027	32.6	4.6	32.6	4.6	330.6	1.000	15.56	0.981
4	20.559	20.587	34.5	1.4	34.5	1.4	329.3	0.999	15.65	0.988
5	18.639	18.702	36.4	0.4	36.4	0.4	327.4	1.000	15.55	0.994
6	16.723	16.883	39.6	0.1	39.6	0.1	327.7	1.001	15.63	0.994
7	15.286	15.585	43.3	3.6	43.3	3.6	329.2	0.998	15.75	0.960
8	14.803	15.174	44.7	4.7	44.7	4.7	330.4	0.996	15.65	0.928
9	14.318	14.773	48.7	2.1	48.7	2.1	330.8	0.994	15.26	0.956

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	225.5	169.4	225.5	169.4	182.0	168.7	133.1	14.7	0.	0.
2	240.9	181.3	240.9	181.3	200.4	180.4	133.7	18.1	0.	0.
3	245.6	193.0	245.6	193.0	207.0	192.4	132.2	15.4	0.	0.
4	255.8	205.2	255.8	205.2	210.8	205.1	145.0	4.9	0.	0.
5	266.5	214.4	266.5	214.4	214.6	214.4	158.0	1.4	0.	0.
6	277.7	222.4	277.7	222.4	213.9	222.4	177.2	0.3	0.	0.
7	289.0	215.9	289.0	215.9	210.5	215.5	198.0	13.6	0.	0.
8	295.5	208.2	295.5	208.2	210.0	207.5	207.9	16.9	0.	0.
9	281.2	198.3	281.2	198.3	185.7	198.1	211.1	7.2	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT			
1	0.640	0.473	0.640	0.473	0.517	0.471	0.113	0.927	0.919
2	0.690	0.509	0.690	0.509	0.574	0.507	0.108	0.900	0.942
3	0.707	0.545	0.707	0.545	0.596	0.543	0.073	0.930	0.942
4	0.741	0.583	0.741	0.583	0.610	0.583	0.033	0.973	1.015
5	0.778	0.613	0.778	0.613	0.627	0.613	0.037	0.999	1.031
6	0.815	0.637	0.815	0.637	0.627	0.637	0.040	1.040	1.046
7	0.850	0.616	0.850	0.616	0.619	0.615	0.098	1.024	1.057
8	0.870	0.592	0.870	0.592	0.619	0.590	0.130	0.988	1.059
9	0.822	0.562	0.822	0.562	0.543	0.562	0.148	1.067	1.047

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	2.1	-4.6	14.0	0.419	0.	0.129	0.129	0.041	0.041
2	10.00	1.4	-5.2	14.0	0.399	0.	0.154	0.154	0.048	0.048
3	15.00	1.2	-5.1	12.3	0.361	0.	0.067	0.067	0.021	0.021
4	30.00	2.8	-2.7	8.9	0.356	0.	0.041	0.041	0.012	0.012
5	50.00	2.4	-2.2	8.4	0.350	0.	0.018	0.018	0.005	0.005
6	70.00	1.6	-1.8	8.9	0.349	0.	0.017	0.017	0.004	0.004
7	85.00	0.4	-2.2	13.2	0.369	0.	0.106	0.106	0.025	0.025
8	90.00	-0.4	-2.8	14.7	0.429	0.	0.184	0.184	0.038	0.038
9	95.00	0.8	-1.4	12.7	0.440	0.	0.177	0.177	0.036	0.036

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(f) 100 Percent of design speed; reading 3185

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	37.2	4.7	37.2	4.7	334.6	0.998	15.26	0.969
2	22.484	22.504	34.0	5.1	34.0	5.1	332.6	0.999	15.68	0.961
3	22.004	22.027	33.1	4.4	33.1	4.4	331.2	0.999	15.75	0.975
4	20.559	20.587	34.9	1.5	34.9	1.5	329.2	0.999	15.64	0.989
5	18.639	18.702	36.5	0.3	36.5	0.3	327.3	1.000	15.52	0.993
6	16.725	16.883	39.8	0.3	39.8	0.3	327.4	1.001	15.52	0.998
7	15.286	15.585	43.3	3.7	43.3	3.7	329.4	0.997	15.76	0.957
8	14.803	15.174	45.1	4.9	45.1	4.9	330.3	0.996	15.74	0.935
9	14.318	14.773	49.0	2.2	49.0	2.2	330.0	0.994	15.26	0.937

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	224.9	169.1	224.9	169.1	179.3	168.6	135.8	13.7	0.	0.
2	239.7	180.0	239.7	180.0	198.8	179.3	134.0	15.9	0.	0.
3	245.5	191.7	245.5	191.7	205.5	191.1	134.2	14.5	0.	0.
4	254.1	202.5	254.1	202.5	208.4	202.4	145.5	5.3	0.	0.
5	265.2	212.0	265.2	212.0	213.2	212.0	157.7	1.1	0.	0.
6	274.0	219.6	274.0	219.6	210.5	219.6	175.3	1.2	0.	0.
7	289.0	212.7	289.0	212.7	210.4	212.3	198.2	13.7	0.	0.
8	291.6	205.6	291.6	205.6	205.7	204.9	206.6	17.4	0.	0.
9	280.7	195.7	280.7	195.7	184.1	195.5	211.8	7.5	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.638	0.472	0.638	0.472	0.508	0.471	0.108	0.940	0.937
2	0.686	0.505	0.686	0.505	0.569	0.503	0.101	0.902	0.945
3	0.706	0.538	0.706	0.538	0.591	0.536	0.071	0.925	0.955
4	0.736	0.575	0.736	0.575	0.603	0.575	0.034	0.971	1.018
5	0.774	0.606	0.774	0.606	0.622	0.606	0.038	0.994	1.029
6	0.803	0.629	0.803	0.629	0.617	0.629	0.042	1.043	1.035
7	0.850	0.607	0.850	0.607	0.619	0.606	0.100	1.009	1.058
8	0.857	0.585	0.857	0.585	0.605	0.582	0.139	0.996	1.057
9	0.820	0.555	0.820	0.555	0.538	0.554	0.154	1.062	1.055

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	3.1	-3.6	13.6	0.425	0.	0.128	0.128	0.041	0.041
2	10.00	1.6	-4.9	13.3	0.405	0.	0.143	0.143	0.045	0.045
3	15.00	1.8	-4.5	12.1	0.374	0.	0.090	0.090	0.028	0.028
4	30.00	3.2	-2.3	9.0	0.363	0.	0.057	0.057	0.011	0.011
5	50.00	2.5	-2.0	8.3	0.356	0.	0.020	0.020	0.005	0.005
6	70.00	1.7	-1.7	9.1	0.348	0.	0.006	0.006	0.002	0.002
7	85.00	0.5	-2.2	13.3	0.401	0.	0.114	0.114	0.025	0.025
8	90.00	0.0	-2.4	14.9	0.429	0.	0.170	0.170	0.036	0.036
9	95.00	1.1	-1.0	12.8	0.448	0.	0.178	0.178	0.036	0.036

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(g) 100 Percent of design speed; reading 3181

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	38.1	5.1	38.1	5.1	335.3	0.998	15.31	0.972
2	22.484	22.504	35.7	5.5	35.7	5.5	333.7	0.998	15.73	0.962
3	22.004	22.027	34.9	4.6	34.9	4.6	332.2	0.999	15.80	0.975
4	20.559	20.587	35.6	1.6	35.6	1.6	330.1	0.998	15.69	0.988
5	18.639	18.702	37.4	0.5	37.4	0.5	327.7	1.000	15.56	0.992
6	16.723	16.883	40.2	0.1	40.2	0.1	327.2	1.000	15.41	0.998
7	15.286	15.585	43.8	3.9	43.8	3.9	328.8	0.998	15.56	0.964
8	14.803	15.174	45.4	4.7	45.4	4.7	330.0	0.996	15.75	0.932
9	14.318	14.773	49.4	1.9	49.4	1.9	330.4	0.995	15.19	0.940

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	223.7	167.6	223.7	167.6	176.1	167.0	137.9	14.8	0.	0.
2	237.5	176.5	237.5	176.5	192.9	175.7	138.5	16.8	0.	0.
3	242.3	187.0	242.3	187.0	198.3	186.4	138.6	14.9	0.	0.
4	250.4	196.8	250.4	196.8	203.5	196.8	145.9	5.6	0.	0.
5	261.3	205.2	261.3	205.2	207.5	205.2	158.8	1.8	0.	0.
6	266.9	210.1	266.9	210.1	203.8	210.1	172.3	0.3	0.	0.
7	281.1	205.5	281.1	205.5	202.8	205.0	194.7	13.8	0.	0.
8	288.6	199.4	288.6	199.4	202.8	198.7	205.4	16.4	0.	0.
9	275.7	190.2	275.7	190.2	179.4	190.1	209.3	6.3	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.633	0.467	0.633	0.467	0.499	0.465	0.112	0.948	0.950
2	0.678	0.494	0.678	0.494	0.550	0.492	0.106	0.911	0.972
3	0.695	0.526	0.695	0.526	0.570	0.524	0.073	0.938	0.982
4	0.722	0.557	0.722	0.557	0.587	0.557	0.040	0.967	1.017
5	0.761	0.585	0.761	0.585	0.604	0.585	0.039	0.989	1.037
6	0.779	0.600	0.779	0.600	0.595	0.600	0.042	1.031	1.017
7	0.824	0.585	0.824	0.585	0.595	0.584	0.103	1.011	1.043
8	0.848	0.566	0.848	0.566	0.596	0.564	0.125	0.980	1.053
9	0.804	0.538	0.804	0.538	0.523	0.538	0.147	1.059	1.046

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	4.0	-2.7	14.0	0.428	0.	0.118	0.118	0.038	0.038
2	10.00	3.3	-3.2	13.7	0.419	0.	0.145	0.145	0.046	0.046
3	15.00	3.5	-2.8	12.3	0.396	0.	0.089	0.089	0.028	0.028
4	30.00	3.9	-1.6	9.2	0.376	0.	0.040	0.040	0.012	0.012
5	50.00	3.4	-1.1	8.5	0.372	0.	0.026	0.026	0.007	0.007
6	70.00	2.2	-1.3	8.9	0.364	0.	0.005	0.005	0.001	0.001
7	85.00	1.0	-1.6	13.5	0.407	0.	0.099	0.099	0.021	0.021
8	90.00	0.2	-2.2	14.8	0.444	0.	0.181	0.181	0.038	0.038
9	95.00	1.5	-0.6	12.5	0.457	0.	0.174	0.174	0.035	0.035

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TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(h) 100 Percent of design speed; reading 3183

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.959	22.969	38.4	4.9	38.4	4.9	335.5	0.998	15.26	0.971
2	22.484	22.504	36.0	5.2	36.0	5.2	333.8	0.998	15.69	0.960
3	22.004	22.027	35.3	4.6	35.3	4.6	332.7	0.998	15.78	0.972
4	20.559	20.587	36.9	1.6	36.9	1.6	330.4	0.998	15.65	0.986
5	18.639	18.702	39.1	0.6	39.1	0.6	328.1	0.999	15.44	0.991
6	16.723	16.883	42.2	0.2	42.2	0.2	327.6	0.999	15.29	0.991
7	15.286	15.585	44.9	4.5	44.9	4.5	329.2	0.998	15.62	0.957
8	14.803	15.174	46.1	4.9	46.1	4.9	330.0	0.996	15.68	0.936
9	14.318	14.773	50.0	1.4	50.0	1.4	330.4	0.995	15.20	0.942

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	221.9	166.1	221.9	166.1	173.8	165.5	138.0	14.1	0.	0.
2	235.9	174.7	235.9	174.7	190.8	173.9	138.7	15.7	0.	0.
3	240.8	184.6	240.8	184.6	196.6	184.0	139.0	14.7	0.	0.
4	245.7	190.5	245.7	190.5	196.5	190.4	147.5	5.4	0.	0.
5	252.3	193.1	252.3	193.1	195.9	193.0	159.1	2.0	0.	0.
6	258.1	195.0	258.1	195.0	191.2	195.0	173.4	0.6	0.	0.
7	276.5	194.1	276.5	194.1	195.7	193.5	195.4	15.2	0.	0.
8	280.6	188.6	280.6	188.6	194.6	187.9	202.2	16.2	0.	0.
9	270.0	180.7	270.0	180.7	173.7	180.6	206.7	4.5	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.628	0.462	0.628	0.462	0.492	0.461	0.110	0.952	0.950
2	0.673	0.489	0.673	0.489	0.544	0.487	0.101	0.912	0.972
3	0.689	0.519	0.689	0.519	0.563	0.517	0.074	0.936	0.985
4	0.707	0.538	0.707	0.538	0.566	0.538	0.046	0.959	1.026
5	0.731	0.548	0.731	0.548	0.568	0.548	0.043	0.985	1.039
6	0.750	0.554	0.750	0.554	0.556	0.554	0.046	1.020	1.033
7	0.809	0.550	0.809	0.550	0.572	0.549	0.124	0.989	1.056
8	0.821	0.534	0.821	0.534	0.569	0.532	0.135	0.996	1.045
9	0.785	0.510	0.785	0.510	0.505	0.510	0.153	1.040	1.038

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.4	-2.3	13.8	0.432	0.	0.124	0.124	0.040	0.040
2	10.00	3.7	-2.9	13.4	0.424	0.	0.153	0.153	0.048	0.048
3	15.00	3.9	-2.4	12.3	0.393	0.	0.101	0.101	0.031	0.031
4	30.00	5.2	-0.3	9.2	0.392	0.	0.051	0.051	0.015	0.015
5	50.00	5.1	0.5	8.6	0.398	0.	0.032	0.032	0.008	0.008
6	70.00	4.2	0.7	9.0	0.402	0.	0.029	0.029	0.007	0.007
7	85.00	2.1	-0.5	14.1	0.457	0.	0.125	0.125	0.027	0.027
8	90.00	1.0	-1.4	15.0	0.465	0.	0.180	0.180	0.038	0.038
9	95.00	2.1	-0.1	12.0	0.481	0.	0.173	0.173	0.035	0.035

TABLE XV. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR STATOR 9D

(i) 100 Percent of design speed; reading 3164

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	38.8	5.0	36.8	5.0	335.8	0.996	15.05	0.971
2	22.484	22.504	36.2	5.4	36.2	5.4	334.0	0.997	15.48	0.959
3	22.004	22.027	35.6	4.6	35.6	4.6	332.6	0.998	15.55	0.970
4	20.559	20.587	37.2	1.6	37.2	1.6	330.1	0.999	15.37	0.983
5	18.639	18.702	40.1	0.5	40.1	0.5	328.2	0.999	15.17	0.966
6	16.723	16.863	42.8	0.3	42.8	0.3	328.0	0.999	15.17	0.968
7	15.286	15.585	44.9	4.4	44.9	4.4	329.3	0.998	15.54	0.956
8	14.803	15.174	46.3	4.7	46.3	4.7	330.0	0.997	15.65	0.938
9	14.318	14.773	49.7	1.3	49.7	1.3	330.6	0.995	15.29	0.940

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	218.2	163.3	218.2	163.3	170.0	162.7	136.8	14.3	0.	0.
2	231.8	171.7	231.8	171.7	187.0	170.9	136.9	16.3	0.	0.
3	236.3	180.8	236.3	180.8	192.0	180.2	137.7	14.6	0.	0.
4	239.9	184.7	239.9	184.7	191.0	184.6	145.1	5.1	0.	0.
5	246.9	184.8	246.9	184.8	188.9	184.8	159.0	1.7	0.	0.
6	255.1	188.9	255.1	188.9	187.2	188.9	173.3	1.1	0.	0.
7	273.0	188.7	273.0	188.7	193.4	188.2	192.6	14.3	0.	0.
8	278.3	187.1	278.3	187.1	192.2	186.5	201.2	15.5	0.	0.
9	271.2	181.7	271.2	181.7	175.5	181.6	206.8	4.3	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT			
1	0.616	0.455	0.616	0.455	0.480	0.453	0.116	0.957	0.940
2	0.660	0.480	0.660	0.480	0.532	0.478	0.108	0.914	0.958
3	0.675	0.508	0.675	0.508	0.549	0.506	0.080	0.938	0.972
4	0.689	0.521	0.689	0.521	0.549	0.521	0.057	0.967	1.008
5	0.714	0.523	0.714	0.523	0.546	0.523	0.054	0.978	1.039
6	0.740	0.536	0.740	0.536	0.543	0.536	0.054	1.009	1.034
7	0.797	0.534	0.797	0.534	0.564	0.533	0.122	0.973	1.039
8	0.813	0.529	0.813	0.529	0.562	0.527	0.131	0.970	1.040
9	0.789	0.513	0.789	0.513	0.511	0.512	0.147	1.035	1.035

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	4.7	-2.0	14.0	0.433	0.	0.126	0.126	0.041	0.041
2	10.00	3.9	-2.7	13.7	0.424	0.	0.162	0.162	0.051	0.051
3	15.00	4.3	-2.0	12.4	0.396	0.	0.112	0.112	0.035	0.035
4	30.00	5.5	-0.0	9.1	0.399	0.	0.062	0.062	0.018	0.018
5	50.00	6.1	1.5	8.6	0.418	0.	0.049	0.049	0.013	0.013
6	70.00	4.8	1.3	9.1	0.418	0.	0.039	0.039	0.009	0.009
7	85.00	2.1	-0.6	14.0	0.448	0.	0.128	0.128	0.028	0.028
8	90.00	1.2	-1.2	14.8	0.466	0.	0.175	0.175	0.037	0.037
9	95.00	1.8	-0.3	11.9	0.480	0.	0.178	0.178	0.036	0.036

TABLE XV. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR STATOR 9D

(j) 90 Percent of design speed; reading 3180

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	27.5	5.8	27.5	5.8	318.1	0.998	13.20	0.964
2	22.484	22.504	25.9	5.2	25.9	5.2	317.2	0.999	13.67	0.958
3	22.004	22.027	25.9	2.6	25.9	2.6	316.4	1.000	13.81	0.973
4	20.559	20.587	28.1	-1.3	28.1	-1.3	316.3	1.001	13.92	0.990
5	18.639	18.702	31.9	-1.0	31.9	-1.0	316.9	1.002	14.04	0.991
6	16.723	16.883	36.5	-0.5	36.5	-0.5	318.2	1.003	14.22	0.983
7	15.286	15.585	40.8	1.3	40.8	1.3	320.8	1.000	14.52	0.962
8	14.803	15.174	42.7	3.3	42.7	3.3	322.0	0.998	14.65	0.936
9	14.318	14.773	46.5	4.0	46.5	4.0	323.0	0.995	14.31	0.928

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	210.5	178.9	210.5	178.9	186.7	178.0	97.3	18.2	0.	0.
2	227.3	193.9	227.3	193.9	204.5	193.1	99.2	17.4	0.	0.
3	232.9	205.8	232.9	205.8	209.6	205.5	101.6	9.4	0.	0.
4	240.7	219.2	240.7	219.2	212.4	219.2	113.2	-5.0	0.	0.
5	250.4	227.6	250.4	227.6	212.6	227.6	132.2	-3.9	0.	0.
6	263.6	234.8	263.6	234.8	212.0	234.8	156.6	-2.2	0.	0.
7	282.1	239.8	282.1	239.8	213.6	239.8	184.3	5.4	0.	0.
8	289.1	238.3	289.1	238.3	212.5	237.9	196.1	13.9	0.	0.
9	284.5	232.0	284.5	232.0	196.0	231.4	206.2	16.3	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		**TOTAL LOSS COEFF, WAKE**	MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT			
1	0.610	0.514	0.610	0.514	0.541	0.511	0.148	0.954	0.673
2	0.664	0.560	0.664	0.560	0.598	0.558	0.132	0.944	0.681
3	0.683	0.597	0.683	0.597	0.615	0.596	0.078	0.981	0.711
4	0.708	0.639	0.708	0.639	0.625	0.659	0.033	1.032	0.790
5	0.739	0.665	0.739	0.665	0.628	0.665	0.050	1.070	0.850
6	0.781	0.686	0.781	0.686	0.628	0.686	0.073	1.107	0.904
7	0.839	0.700	0.839	0.700	0.636	0.700	0.095	1.123	0.958
8	0.861	0.694	0.661	0.694	0.633	0.693	0.137	1.119	0.974
9	0.844	0.674	0.844	0.674	0.581	0.673	0.169	1.181	1.003

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-6.5	-13.3	14.8	0.271	0.	0.164	0.164	0.053	0.053
2	10.00	-6.5	-13.0	13.4	0.261	0.	0.162	0.162	0.051	0.051
3	15.00	-5.5	-11.8	10.4	0.239	0.	0.099	0.099	0.031	0.031
4	30.00	-3.6	-9.2	6.2	0.231	0.	0.036	0.036	0.011	0.011
5	50.00	-2.1	-6.7	7.1	0.233	0.	0.028	0.028	0.007	0.007
6	70.00	-1.6	-5.0	8.2	0.251	0.	0.051	0.051	0.012	0.012
7	85.00	-2.0	-4.7	10.9	0.286	0.	0.102	0.102	0.022	0.022
8	90.00	-2.4	-4.8	13.4	0.306	0.	0.167	0.167	0.035	0.035
9	95.00	-1.4	-3.6	14.6	0.318	0.	0.193	0.193	0.039	0.039

TABLE XV. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR STATOR 9D

(k) 90 Percent of design speed; reading 3179

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	31.1	3.9	31.1	3.9	320.7	0.999	13.63	0.972
2	22.484	22.504	29.0	4.1	29.0	4.1	319.4	1.000	14.07	0.965
3	22.004	22.027	28.9	2.1	28.9	2.1	318.7	1.000	14.12	0.980
4	20.559	20.587	30.4	0.1	30.4	0.1	318.4	1.000	14.18	0.988
5	18.639	18.702	34.0	0.0	34.0	0.0	318.2	1.000	14.18	0.994
6	16.723	16.883	37.9	-0.1	37.9	-0.1	318.8	1.001	14.19	1.000
7	15.286	15.585	41.9	2.2	41.9	2.2	320.9	1.000	14.47	0.980
8	14.803	15.174	43.5	4.4	43.5	4.4	322.2	0.998	14.67	0.945
9	14.318	14.773	47.0	3.3	47.0	3.3	323.2	0.995	14.33	0.944

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	204.6	164.7	204.6	164.7	175.2	164.3	105.7	11.2	0.	0.
2	220.7	178.0	220.7	178.0	193.0	177.5	106.9	12.8	0.	0.
3	224.8	187.9	224.8	187.9	196.8	187.8	108.5	7.0	0.	0.
4	233.8	197.5	233.8	197.5	201.7	197.5	118.2	0.3	0.	0.
5	243.9	205.8	243.9	205.8	202.1	205.8	136.6	0.0	0.	0.
6	253.3	213.3	253.3	213.3	199.9	213.3	155.6	-0.3	0.	0.
7	270.3	217.0	270.3	217.0	201.2	216.8	180.5	8.4	0.	0.
8	279.0	211.6	279.0	211.6	202.6	211.0	191.9	16.4	0.	0.
9	273.2	205.7	273.2	205.7	186.3	205.3	199.7	12.0	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.589	0.469	0.589	0.469	0.505	0.468	0.116	0.938	0.740
2	0.641	0.510	0.641	0.510	0.561	0.508	0.106	0.920	0.761
3	0.654	0.540	0.654	0.540	0.573	0.540	0.058	0.954	0.781
4	0.683	0.570	0.683	0.570	0.590	0.570	0.031	0.979	0.831
5	0.716	0.596	0.716	0.596	0.594	0.596	0.037	1.016	0.888
6	0.746	0.618	0.746	0.618	0.589	0.618	0.042	1.067	0.909
7	0.799	0.628	0.799	0.628	0.595	0.627	0.062	1.078	0.950
8	0.827	0.610	0.827	0.610	0.600	0.609	0.129	1.042	0.964
9	0.806	0.592	0.806	0.592	0.550	0.591	0.143	1.102	0.975

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	-3.0	-9.7	12.9	0.344	0.	0.132	0.132	0.043	0.043
2	10.00	-3.4	-9.9	12.4	0.328	0.	0.146	0.146	0.046	0.046
3	15.00	-2.5	-8.8	9.9	0.304	0.	0.082	0.082	0.025	0.025
4	30.00	-1.3	-6.9	7.6	0.301	0.	0.043	0.043	0.012	0.012
5	50.00	0.0	-4.5	8.1	0.303	0.	0.021	0.021	0.006	0.006
6	70.00	-0.1	-3.6	8.7	0.303	0.	0.001	0.001	0.000	0.000
7	85.00	-0.9	-3.6	11.8	0.334	0.	0.059	0.059	0.013	0.013
8	90.00	-1.7	-4.1	14.5	0.372	0.	0.151	0.151	0.032	0.032
9	95.00	-0.9	-3.0	13.9	0.384	0.	0.162	0.162	0.033	0.033

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TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(ℓ) 90 Percent of design speed; reading 3178

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.959	22.969	34.6	4.3	34.6	4.3	325.4	0.998	13.95	0.974
2	22.484	22.504	32.4	5.1	32.4	5.1	322.1	0.999	14.30	0.969
3	22.004	22.027	31.6	3.7	31.6	3.7	321.2	1.000	14.38	0.981
4	20.559	20.587	33.4	1.0	33.4	1.0	320.1	1.000	14.34	0.992
5	18.639	18.702	35.8	0.3	35.8	0.3	319.0	1.000	14.25	0.995
6	16.723	16.883	39.4	-0.3	39.4	-0.3	319.2	1.001	14.20	0.999
7	15.286	15.585	43.3	3.2	43.3	3.2	321.4	0.998	14.47	0.979
8	14.803	15.174	44.8	4.9	44.8	4.9	322.4	0.997	14.67	0.946
9	14.318	14.773	48.2	2.7	48.2	2.7	323.2	0.995	14.33	0.946

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	200.2	156.4	200.2	156.4	164.7	156.0	113.8	11.8	0.	0.
2	214.5	168.3	214.5	168.3	181.2	167.7	114.9	15.1	0.	0.
3	219.7	178.1	219.7	178.1	187.1	177.7	115.1	11.4	0.	0.
4	226.5	186.7	226.5	186.7	189.0	186.7	124.8	3.4	0.	0.
5	235.6	191.7	235.6	191.7	191.1	191.7	137.8	1.0	0.	0.
6	244.4	196.8	244.4	196.8	188.9	196.8	155.0	-1.0	0.	0.
7	260.7	199.4	260.7	199.4	189.9	199.1	178.6	11.3	0.	0.
8	269.1	193.8	269.1	193.8	190.9	193.1	189.7	16.7	0.	0.
9	261.4	186.9	261.4	186.9	174.1	186.7	194.9	8.8	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.573	0.443	0.573	0.443	0.473	0.442	0.109	0.947	0.793
2	0.619	0.479	0.619	0.479	0.522	0.477	0.102	0.926	0.816
3	0.636	0.508	0.636	0.508	0.542	0.507	0.062	0.950	0.825
4	0.658	0.535	0.658	0.535	0.549	0.535	0.032	0.989	0.877
5	0.689	0.551	0.689	0.551	0.558	0.551	0.037	1.003	0.899
6	0.716	0.567	0.716	0.567	0.554	0.567	0.042	1.042	0.913
7	0.767	0.573	0.767	0.573	0.559	0.572	0.081	1.048	0.953
8	0.793	0.556	0.793	0.556	0.563	0.554	0.126	1.011	0.969
9	0.767	0.535	0.767	0.535	0.511	0.554	0.140	1.072	0.964

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	0.6	-6.1	13.3	0.383	0.	0.129	0.129	0.042	0.042
2	10.00	0.0	-6.5	13.4	0.362	0.	0.136	0.136	0.043	0.043
3	15.00	0.2	-6.1	11.5	0.355	0.	0.081	0.081	0.025	0.025
4	30.00	1.8	-3.8	8.6	0.331	0.	0.030	0.030	0.009	0.009
5	50.00	1.8	-2.7	8.3	0.339	0.	0.020	0.020	0.005	0.005
6	70.00	1.3	-2.1	8.5	0.345	0.	0.004	0.004	0.001	0.001
7	85.00	0.4	-2.2	12.9	0.373	0.	0.064	0.064	0.014	0.014
8	90.00	-0.3	-2.7	15.0	0.413	0.	0.158	0.158	0.033	0.033
9	95.00	0.4	-1.8	13.3	0.427	0.	0.167	0.167	0.034	0.034

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(m) 90 Percent of design speed; reading 3165

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	36.7	4.7	36.7	4.7	324.7	0.999	13.99	0.978
2	22.484	22.504	33.9	5.2	33.9	5.2	323.5	0.999	14.36	0.968
3	22.004	22.027	33.9	4.2	33.9	4.2	322.5	0.999	14.40	0.981
4	20.559	20.587	35.3	1.3	35.3	1.3	320.7	0.999	14.25	0.991
5	18.639	18.702	38.3	0.1	38.3	0.1	319.4	0.999	14.08	0.995
6	16.723	16.883	41.4	-0.4	41.4	-0.4	319.6	0.999	14.15	0.992
7	15.286	15.585	44.3	3.9	44.3	3.9	321.6	0.998	14.49	0.973
8	14.803	15.174	45.6	5.0	45.6	5.0	322.8	0.996	14.64	0.948
9	14.318	14.773	48.9	2.3	48.9	2.3	323.4	0.995	14.37	0.948

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	195.5	151.2	195.5	151.2	156.8	150.7	116.8	12.3	0.	0.
2	209.9	160.6	209.9	160.6	174.2	160.0	117.2	14.5	0.	0.
3	213.9	169.6	213.9	169.6	177.6	169.1	119.1	12.5	0.	0.
4	217.0	173.4	217.0	173.4	177.0	173.3	125.4	4.0	0.	0.
5	222.8	174.9	222.8	174.9	174.7	174.9	138.2	0.4	0.	0.
6	234.8	180.2	234.8	180.2	176.2	180.2	155.2	-1.4	0.	0.
7	253.4	185.4	253.4	185.4	181.3	184.9	177.0	12.7	0.	0.
8	260.1	181.7	260.1	181.7	182.0	181.0	185.8	16.0	0.	0.
9	254.6	176.6	254.6	176.6	167.5	176.4	191.7	7.0	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS COEFF, WAKE	MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT		VEL R	MACH NO
1	0.558	0.426	0.558	0.426	0.447	0.425	0.111	0.861	0.811
2	0.603	0.455	0 603	0.455	0.500	0.453	0.104	0.919	0.828
3	0.616	0.482	0.616	0.482	0.512	0.481	0.066	0.952	0.849
4	0.628	0.495	0.628	0.495	0.512	0.495	0.039	0.979	0.877
5	0.647	0.500	0.647	0.500	0.508	0.500	0.042	1.001	0.905
6	0.685	0.516	0.685	0.516	0.514	0.516	0.045	1.023	0.923
7	0.743	0.530	0.743	0.530	0.531	0.529	0.092	1.020	0.953
8	0.763	0.519	0.763	0.519	0.534	0.517	0.121	0.994	0.955
9	0.744	0.503	0.744	0.503	0.490	0.503	0.147	1.054	0.954

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	2.6	-4.1	13.6	0.399	0.	0.117	0.117	0.038	0.038
2	10.00	1.6	-4.9	13.4	0.389	0.	0.146	0.146	0.046	0.046
3	15.00	2.5	-3.8	12.0	0.362	0.	0.065	0.065	0.026	0.026
4	30.00	3.6	-1.9	6.8	0.363	0.	0.038	0.038	0.011	0.011
5	50.00	4.3	-0.2	8.2	0.377	0.	0.019	0.019	0.005	0.005
6	70.00	3.3	-0.1	8.4	0.389	0.	0.028	0.028	0.007	0.007
7	85.00	1.5	-1.2	13.5	0.407	0.	0.088	0.088	0.019	0.019
8	90.00	0.5	-1.9	15.1	0.437	0.	0.162	0.162	0.034	0.034
9	95.00	1.0	-1.1	12.9	0.451	0.	0.169	0.169	0.034	0.034

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(n) 90 Percent of design speed; reading 3166

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	39.1	4.6	39.1	4.6	325.0	0.999	13.79	0.980
2	22.484	22.504	37.1	5.4	37.1	5.4	324.5	0.999	14.05	0.972
3	22.004	22.027	36.8	4.5	36.8	4.5	323.5	0.999	14.09	0.979
4	20.559	20.587	38.1	1.2	38.1	1.2	321.8	0.998	13.96	0.987
5	18.639	18.702	41.1	0.5	41.1	0.5	320.9	0.999	13.95	0.992
6	16.725	16.883	42.2	-0.0	42.2	-0.0	320.4	0.998	14.12	0.988
7	15.286	15.585	44.9	4.5	44.9	4.5	322.1	0.997	14.50	0.971
8	14.803	15.174	46.2	5.3	46.2	5.3	322.9	0.996	14.68	0.946
9	14.318	14.773	49.4	2.2	49.4	2.2	323.6	0.994	14.41	0.947

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	187.1	141.3	187.1	141.3	145.2	140.8	118.0	11.3	0.	0.
2	198.4	148.0	198.4	148.0	158.3	147.4	119.5	13.8	0.	0.
3	202.3	155.2	202.3	155.2	162.1	154.7	121.1	12.2	0.	0.
4	205.4	157.6	205.4	157.6	161.5	157.6	126.9	3.3	0.	0.
5	215.3	162.7	215.3	162.7	162.3	162.7	141.5	1.5	0.	0.
6	229.0	170.4	229.0	170.4	169.6	170.4	153.9	-0.1	0.	0.
7	248.4	177.9	248.4	177.9	175.8	177.3	175.4	14.1	0.	0.
8	255.6	175.4	255.6	175.4	176.9	174.6	184.4	16.2	0.	0.
9	249.9	170.4	249.9	170.4	162.6	170.2	189.7	6.6	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.532	0.397	0.532	0.397	0.413	0.396	0.114	0.970	0.817
2	0.567	0.417	0.567	0.417	0.452	0.415	0.110	0.931	0.840
3	0.580	0.439	0.580	0.439	0.465	0.437	0.077	0.954	0.857
4	0.591	0.447	0.591	0.447	0.465	0.447	0.061	0.975	0.883
5	0.622	0.463	0.622	0.463	0.469	0.463	0.064	1.003	0.927
6	0.666	0.486	0.666	0.486	0.493	0.486	0.044	1.005	0.917
7	0.726	0.508	0.726	0.508	0.514	0.506	0.101	1.009	0.948
8	0.748	0.500	0.748	0.500	0.518	0.498	0.123	0.987	0.953
9	0.729	0.485	0.729	0.485	0.474	0.484	0.048	1.047	0.948

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	5.0	-1.7	13.6	0.429	0.	0.116	0.116	0.037	0.037
2	10.00	4.7	-1.8	13.6	0.423	0.	0.145	0.145	0.046	0.046
3	15.00	5.4	-0.9	12.3	0.400	0.	0.102	0.102	0.032	0.032
4	30.00	6.5	0.9	8.7	0.407	0.	0.063	0.063	0.018	0.018
5	50.00	7.1	2.6	8.6	0.415	0.	0.036	0.036	0.009	0.009
6	70.00	4.2	0.7	8.7	0.414	0.	0.046	0.046	0.011	0.011
7	85.00	2.1	-0.5	14.2	0.423	0.	0.100	0.100	0.022	0.022
8	90.00	1.1	-1.3	15.3	0.450	0.	0.173	0.173	0.036	0.036
9	95.00	1.5	-0.6	12.8	0.465	0.	0.179	0.179	0.036	0.036

TABLE XV. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR STATOR 9D

(o) 80 Percent of design speed; reading 3167

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	52.3	2.3	52.3	2.3	320.3	0.998	12.82	0.974
2	22.484	22.504	48.4	2.7	48.4	2.7	319.5	0.998	12.91	0.971
3	22.004	22.027	44.9	2.6	44.9	2.6	318.8	0.997	12.97	0.971
4	20.559	20.587	42.8	2.1	42.8	2.1	316.5	0.999	12.98	0.976
5	18.639	18.702	45.2	0.9	45.2	0.9	315.3	0.999	12.97	0.983
6	16.723	16.883	44.6	1.4	44.6	1.4	314.8	0.998	13.23	0.986
7	15.286	15.585	45.5	4.6	45.5	4.6	315.1	0.998	13.52	0.974
8	14.803	15.174	46.9	5.2	46.9	5.2	315.5	0.998	13.63	0.962
9	14.318	14.773	49.8	1.8	49.8	1.8	316.4	0.996	13.51	0.957

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	155.5	110.3	155.5	110.3	95.0	110.2	123.1	4.5	0.	0.
2	162.1	113.7	162.1	113.7	107.7	113.6	121.1	5.3	0.	0.
3	166.7	117.1	166.7	117.1	118.0	116.9	117.7	5.3	0.	0.
4	172.9	123.3	172.9	123.3	126.9	123.2	117.4	4.6	0.	0.
5	180.8	128.8	180.8	128.8	127.4	128.8	128.2	2.0	0.	0.
6	198.6	145.4	198.6	145.4	141.4	145.4	139.4	3.4	0.	0.
7	215.6	153.8	215.6	153.8	151.0	153.3	153.8	12.3	0.	0.
8	221.7	154.1	221.7	154.1	151.4	153.5	161.9	14.0	0.	0.
9	220.4	150.0	220.4	150.0	142.2	149.9	168.4	4.6	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT			
1	0.442	0.311	0.442	0.311	0.270	0.310	0.175	1.159	0.881
2	0.462	0.321	0.462	0.321	0.307	0.321	0.158	1.055	0.862
3	0.476	0.331	0.476	0.331	0.337	0.331	0.148	0.991	0.856
4	0.497	0.350	0.497	0.350	0.364	0.350	0.136	0.971	0.820
5	0.522	0.367	0.522	0.367	0.368	0.367	0.094	1.011	0.849
6	0.577	0.416	0.577	0.416	0.411	0.416	0.077	1.028	0.841
7	0.629	0.441	0.629	0.441	0.441	0.440	0.108	1.015	0.855
8	0.648	0.442	0.648	0.442	0.443	0.440	0.123	1.013	0.843
9	0.643	0.429	0.643	0.429	0.415	0.429	0.125	1.054	0.847

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	18.3	11.6	11.3	0.537	0.	0.205	0.205	0.066	0.066
2	10.00	16.0	9.5	10.9	0.524	0.	0.215	0.215	0.068	0.068
3	15.00	13.6	7.2	10.4	0.507	0.	0.204	0.204	0.063	0.063
4	30.00	11.1	5.5	9.7	0.476	0.	0.154	0.154	0.045	0.045
5	50.00	11.2	6.6	8.9	0.471	0.	0.101	0.101	0.027	0.027
6	70.00	6.6	3.1	10.1	0.429	0.	0.070	0.070	0.016	0.016
7	85.00	2.7	0.0	14.2	0.427	0.	0.110	0.110	0.024	0.024
8	90.00	1.8	-0.6	15.3	0.443	0.	0.155	0.155	0.032	0.032
9	95.00	2.0	-0.2	12.3	0.468	0.	0.177	0.177	0.036	0.036

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TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(p) 70 Percent of design speed; reading 3174

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	21.5	2.9	21.5	2.9	302.5	1.002	11.46	0.978
2	22.484	22.504	20.9	2.6	20.9	2.6	302.2	1.002	11.75	0.977
3	22.004	22.027	20.9	0.2	20.9	0.2	302.1	1.002	11.80	0.989
4	20.559	20.587	23.2	-1.8	23.2	-1.8	302.5	1.002	11.97	0.992
5	18.639	18.702	27.5	-2.2	27.5	-2.2	303.5	1.003	12.16	0.995
6	16.723	16.883	32.8	-1.7	32.8	-1.7	305.5	1.002	12.43	0.993
7	15.266	15.585	37.9	0.6	37.9	0.6	307.7	1.002	12.70	0.991
8	14.803	15.174	39.8	2.6	39.8	2.6	308.5	1.000	12.79	0.972
9	14.318	14.773	42.9	3.8	42.9	3.8	309.7	0.998	12.72	0.959

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	161.0	143.8	161.0	143.8	149.8	143.6	59.1	7.2	0.	0.
2	176.0	157.6	176.0	157.6	164.4	157.5	62.9	7.2	0.	0.
3	179.8	167.3	179.8	167.3	167.9	167.3	64.1	0.7	0.	0.
4	189.7	177.5	189.7	177.5	174.4	177.4	74.7	-5.6	0.	0.
5	201.9	189.2	201.9	189.2	179.1	189.0	93.1	-7.2	0.	0.
6	216.4	201.3	216.4	201.3	182.0	201.3	117.1	-5.9	0.	0.
7	232.7	213.5	232.7	213.5	183.7	213.4	142.8	2.1	0.	0.
8	238.8	213.1	238.8	213.1	183.5	212.9	152.8	9.8	0.	0.
9	241.3	210.6	241.3	210.6	176.6	210.1	164.4	13.9	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.472	0.419	0.472	0.419	0.439	0.419	0.120	0.959	0.472
2	0.518	0.461	0.518	0.461	0.484	0.461	0.107	0.958	0.518
3	0.530	0.491	0.530	0.491	0.495	0.491	0.062	0.996	0.530
4	0.561	0.522	0.561	0.522	0.516	0.522	0.043	1.018	0.561
5	0.598	0.558	0.598	0.558	0.531	0.557	0.036	1.055	0.598
6	0.643	0.594	0.643	0.594	0.540	0.594	0.046	1.106	0.643
7	0.693	0.630	0.693	0.630	0.547	0.630	0.045	1.162	0.693
8	0.712	0.629	0.712	0.629	0.547	0.628	0.095	1.160	0.712
9	0.718	0.620	0.718	0.620	0.526	0.619	0.136	1.190	0.718

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	-12.5	-19.2	11.8	0.211	0.	0.154	0.154	0.050	0.050
2	10.00	-11.4	-17.9	10.9	0.204	0.	0.138	0.138	0.044	0.044
3	15.00	-10.5	-16.8	8.0	0.179	0.	0.062	0.062	0.019	0.019
4	30.00	-8.5	-14.0	5.7	0.187	0.	0.040	0.040	0.012	0.012
5	50.00	-6.6	-11.1	5.8	0.193	0.	0.023	0.023	0.006	0.006
6	70.00	-5.3	-8.7	7.1	0.203	0.	0.030	0.030	0.007	0.007
7	85.00	-4.9	-7.6	10.2	0.212	0.	0.034	0.034	0.007	0.007
8	90.00	-5.3	-7.7	12.7	0.231	0.	0.099	0.099	0.021	0.021
9	95.00	-4.9	-7.1	14.4	0.252	0.	0.140	0.140	0.028	0.028

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(q) 70 Percent of design speed; reading 3171

RP	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	27.0	2.6	27.0	2.6	305.3	1.000	11.65	0.984
2	22.484	22.504	25.5	2.7	25.5	2.7	304.7	1.000	12.09	0.981
3	22.004	22.027	25.0	0.6	25.0	0.6	304.4	1.001	12.15	0.989
4	20.559	20.587	27.1	-1.5	27.1	-1.5	304.4	1.000	12.21	0.994
5	18.639	18.702	30.9	-1.5	30.9	-1.5	305.0	1.000	12.33	0.995
6	16.723	16.883	35.4	-1.0	35.4	-1.0	306.1	1.001	12.49	0.996
7	15.286	15.585	39.7	1.2	39.7	1.2	307.9	1.000	12.70	0.990
8	14.803	15.174	41.6	3.6	41.6	3.6	308.6	0.999	12.81	0.971
9	14.318	14.773	44.7	3.8	44.7	3.8	309.6	0.997	12.71	0.965

RP	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	155.9	132.9	155.9	132.9	138.9	132.8	70.8	5.9	0.	0.
2	168.4	144.1	168.4	144.1	152.0	143.9	72.4	6.7	0.	0.
3	172.7	151.9	172.7	151.9	156.5	151.9	72.8	1.6	0.	0.
4	179.9	159.7	179.9	159.7	160.2	159.6	81.8	-4.1	0.	0.
5	191.5	169.4	191.5	169.4	164.2	169.3	98.4	-4.5	0.	0.
6	204.0	178.5	204.0	178.5	166.3	178.5	118.2	-3.1	0.	0.
7	219.5	186.5	219.5	186.5	168.8	186.4	140.2	4.0	0.	0.
8	225.2	184.0	225.2	184.0	168.5	183.7	149.4	11.5	0.	0.
9	226.2	182.6	226.2	182.6	160.7	182.2	159.3	12.1	0.	0.

RP	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
	IN	OUT	IN	OUT	IN	OUT			
1	0.454	0.385	0.454	0.385	0.405	0.365	0.102	0.956	0.483
2	0.493	0.419	0.493	0.419	0.445	0.418	0.088	0.947	0.493
3	0.506	0.443	0.506	0.443	0.459	0.443	0.045	0.971	0.506
4	0.529	0.466	0.529	0.466	0.471	0.466	0.027	0.996	0.561
5	0.564	0.495	0.564	0.495	0.484	0.495	0.027	1.031	0.624
6	0.602	0.522	0.602	0.522	0.491	0.522	0.037	1.073	0.668
7	0.650	0.546	0.650	0.546	0.500	0.546	0.040	1.104	0.707
8	0.668	0.538	0.668	0.538	0.499	0.537	0.098	1.090	0.716
9	0.670	0.533	0.670	0.533	0.476	0.532	0.125	1.134	0.744

RP	PERCENT SPAN	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
		MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	-7.0	-13.8	11.5	0.282	0.	0.124	0.124	0.040	0.040
2	10.00	-6.9	-13.4	10.9	0.268	0.	0.122	0.122	0.039	0.039
3	15.00	-6.4	-12.7	8.4	0.248	0.	0.069	0.069	0.021	0.021
4	30.00	-4.6	-10.2	6.0	0.251	0.	0.034	0.034	0.010	0.010
5	50.00	-3.1	-7.6	6.5	0.256	0.	0.024	0.024	0.006	0.006
6	70.00	-2.6	-6.1	7.8	0.265	0.	0.020	0.020	0.005	0.005
7	85.00	-3.1	-5.8	10.9	0.283	0.	0.040	0.040	0.009	0.009
8	90.00	-3.5	-6.0	13.6	0.310	0.	0.113	0.113	0.024	0.024
9	95.00	-3.1	-5.3	14.4	0.323	0.	0.133	0.133	0.027	0.027

TABLE XV. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR STATOR 9D

(r) 70 Percent of design speed; reading 3170

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.959	22.969	33.5	3.9	33.5	3.9	308.5	0.999	12.12	0.985
2	22.484	22.504	30.6	4.1	30.6	4.1	307.3	1.000	12.32	0.982
3	22.004	22.027	29.7	2.4	29.7	2.4	306.6	1.000	12.38	0.989
4	20.559	20.587	31.4	0.1	31.4	0.1	306.2	1.000	12.38	0.995
5	18.639	18.702	34.8	-0.2	34.8	-0.2	306.0	1.000	12.40	0.997
6	16.725	16.883	38.7	-0.2	38.7	-0.2	306.5	1.001	12.46	0.999
7	15.286	15.585	42.6	2.5	42.6	2.5	308.2	0.999	12.69	0.989
8	14.803	15.174	44.2	4.9	44.2	4.9	308.9	0.998	12.81	0.969
9	14.318	14.773	46.4	3.2	46.4	3.2	309.6	0.997	12.68	0.966

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	149.6	122.1	149.6	122.1	124.8	121.8	82.5	8.3	0.	0.
2	160.7	131.1	160.7	131.1	138.3	130.8	81.8	9.3	0.	0.
3	164.8	138.6	164.8	138.6	143.2	138.5	81.5	5.9	0.	0.
4	170.1	145.1	170.1	145.1	145.1	145.1	88.7	0.3	0.	0.
5	179.2	150.8	179.2	150.8	147.2	150.8	102.1	-0.7	0.	0.
6	189.8	157.9	189.8	157.9	148.2	157.9	118.7	-0.5	0.	0.
7	205.9	163.7	205.9	163.7	151.5	163.6	139.4	7.0	0.	0.
8	212.4	160.2	212.4	160.2	152.4	159.6	148.0	13.7	0.	0.
9	211.6	157.6	211.6	157.6	145.9	157.4	153.3	8.8	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	**TOTAL LOSS COEFF, WAKE**	MERID VEL R	PEAK SS MACH NO
1	0.433	0.351	0.433	0.351	0.361	0.350	0.089	0.976	0.581
2	0.467	0.378	0.467	0.378	0.402	0.378	0.105	0.946	0.585
3	0.480	0.401	0.480	0.401	0.417	0.401	0.064	0.967	0.588
4	0.497	0.421	0.497	0.421	0.424	0.421	0.000	0.999	0.625
5	0.525	0.438	0.525	0.438	0.431	0.438	0.025	1.024	0.665
6	0.558	0.459	0.558	0.459	0.435	0.459	0.000	1.065	0.696
7	0.606	0.476	0.606	0.476	0.446	0.475	0.048	1.079	0.738
8	0.626	0.465	0.626	0.465	0.449	0.463	0.123	1.048	0.748
9	0.623	0.457	0.623	0.457	0.430	0.456	0.125	1.078	0.739

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-0.6	-7.3	12.9	0.344	0.	0.124	0.124	0.040	0.040
2	10.00	-1.7	-8.3	12.3	0.327	0.	0.128	0.128	0.041	0.041
3	15.00	-1.7	-8.0	10.2	0.301	0.	0.077	0.077	0.024	0.024
4	30.00	-0.3	-5.8	7.6	0.298	0.	0.035	0.035	0.010	0.010
5	50.00	0.7	-3.8	7.8	0.309	0.	0.020	0.020	0.005	0.005
6	70.00	0.6	-2.8	8.6	0.316	0.	0.003	0.003	0.001	0.001
7	85.00	-0.2	-2.9	12.1	0.342	0.	0.050	0.050	0.011	0.011
8	90.00	-1.0	-3.4	15.0	0.377	0.	0.135	0.135	0.028	0.028
9	95.00	-1.5	-3.6	13.8	0.391	0.	0.147	0.147	0.030	0.030

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(s) 70 Percent of design speed; reading 3169

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	41.7	5.2	41.7	5.2	310.8	0.999	12.20	0.986
2	22.484	22.504	38.5	4.9	38.5	4.9	309.8	0.999	12.31	0.984
3	22.004	22.027	36.0	3.7	36.0	3.7	308.8	1.000	12.37	0.987
4	20.559	20.587	36.7	0.6	36.7	0.6	307.6	1.000	12.36	0.992
5	18.639	18.702	40.5	0.4	40.5	0.4	307.5	1.000	12.37	0.994
6	16.723	16.883	43.1	0.0	43.1	0.0	307.5	0.999	12.46	0.993
7	15.286	15.585	45.1	4.0	45.1	4.0	308.6	0.998	12.70	0.980
8	14.803	15.174	46.5	5.2	46.5	5.2	308.9	0.998	12.75	0.969
9	14.318	14.773	48.7	1.8	48.7	1.8	309.5	0.997	12.66	0.965

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	141.8	108.8	141.8	108.8	105.8	108.4	94.4	9.8	0.	0.
2	148.8	113.8	148.8	113.8	116.5	113.4	92.6	9.6	0.	0.
3	153.0	120.1	153.0	120.1	123.8	119.8	90.0	7.8	0.	0.
4	157.4	125.4	157.4	125.4	126.1	125.4	94.1	1.4	0.	0.
5	165.7	129.6	165.7	129.6	126.0	129.6	107.6	1.0	0.	0.
6	176.8	135.9	176.8	135.9	129.0	135.9	120.9	0.1	0.	0.
7	193.4	141.3	193.4	141.3	136.4	141.0	137.1	10.0	0.	0.
8	197.4	139.2	197.4	139.2	136.0	138.6	143.2	12.7	0.	0.
9	196.8	135.6	196.8	135.6	129.8	135.5	147.8	4.2	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT			
1	0.408	0.311	0.408	0.311	0.304	0.310	0.130	1.024	0.665
2	0.430	0.326	0.430	0.326	0.335	0.325	0.104	0.973	0.657
3	0.443	0.345	0.443	0.345	0.358	0.344	0.080	0.968	0.643
4	0.457	0.361	0.457	0.361	0.366	0.361	0.050	0.994	0.660
5	0.482	0.374	0.482	0.374	0.367	0.374	0.057	1.029	0.708
6	0.516	0.393	0.516	0.393	0.377	0.393	0.047	1.054	0.727
7	0.567	0.408	0.567	0.408	0.400	0.407	0.098	1.034	0.744
8	0.579	0.402	0.579	0.402	0.399	0.400	0.127	1.019	0.744
9	0.576	0.391	0.576	0.391	0.380	0.391	0.129	1.044	0.755

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	7.7	1.0	14.1	0.426	0.	0.125	0.125	0.040	0.040
2	10.00	6.1	-0.4	13.1	0.412	0.	0.132	0.132	0.041	0.041
3	15.00	4.6	-1.7	11.5	0.382	0.	0.103	0.103	0.032	0.032
4	30.00	5.0	-0.5	8.2	0.374	0.	0.061	0.061	0.018	0.018
5	50.00	6.5	1.9	8.5	0.388	0.	0.040	0.040	0.011	0.011
6	70:00	5.1	1.7	8.8	0.392	0.	0.041	0.041	0.010	0.010
7	85.00	2.3	-0.3	13.7	0.410	0.	0.102	0.102	0.022	0.022
8	90.00	1.4	-1.1	15.3	0.432	0.	0.155	0.155	0.032	0.032
9	95.00	0.8	-1.3	12.4	0.457	0.	0.174	0.174	0.035	0.035

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TABLE XV. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR STATOR 9D

(t) 70 Percent of design speed; reading 3168

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.959	22.969	54.4	1.8	54.4	1.8	313.3	0.998	12.19	0.977
2	22.484	22.504	50.7	2.1	50.7	2.1	312.7	0.998	12.23	0.977
3	22.004	22.027	46.9	2.1	46.9	2.1	311.6	0.999	12.26	0.977
4	20.559	20.587	43.7	1.9	43.7	1.9	310.0	0.999	12.28	0.979
5	18.659	18.702	45.9	0.9	45.9	0.9	309.0	0.999	12.28	0.985
6	16.723	16.883	45.3	1.3	45.3	1.3	308.7	0.998	12.46	0.989
7	15.286	15.585	45.7	4.6	45.7	4.6	309.0	0.998	12.71	0.974
8	14.803	15.174	47.0	5.3	47.0	5.3	309.2	0.999	12.75	0.967
9	14.318	14.773	50.1	1.6	50.1	1.6	309.8	0.997	12.67	0.964

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	135.3	95.8	135.3	95.8	78.9	95.8	110.0	3.0	0.	0.
2	139.9	98.5	139.9	98.5	88.6	98.4	108.3	3.6	0.	0.
3	143.6	101.1	143.6	101.1	98.2	101.0	104.8	3.6	0.	0.
4	149.3	106.1	149.3	106.1	107.9	106.1	103.2	3.6	0.	0.
5	157.0	112.3	157.0	112.3	109.3	112.3	112.7	1.8	0.	0.
6	171.8	127.2	171.8	127.2	120.9	127.1	122.0	2.8	0.	0.
7	188.3	131.8	188.3	131.8	131.6	131.4	134.7	10.7	0.	0.
8	192.2	131.8	192.2	131.8	131.1	131.3	140.6	12.1	0.	0.
9	191.7	128.9	191.7	128.9	122.9	128.9	147.1	3.5	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.387	0.272	0.387	0.272	0.226	0.272	0.182	1.215	0.600
2	0.401	0.280	0.401	0.280	0.254	0.280	0.150	1.111	0.762
3	0.413	0.288	0.413	0.288	0.282	0.288	0.162	1.029	0.752
4	0.431	0.304	0.431	0.304	0.311	0.303	0.121	0.983	0.725
5	0.455	0.322	0.455	0.322	0.316	0.322	0.103	1.028	0.751
6	0.500	0.366	0.500	0.366	0.352	0.366	0.082	1.051	0.740
7	0.550	0.380	0.550	0.380	0.385	0.379	0.108	0.999	0.735
8	0.562	0.380	0.562	0.380	0.383	0.378	0.115	1.002	0.733
9	0.560	0.371	0.560	0.371	0.359	0.371	0.140	1.049	0.743

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	20.3	13.6	10.8	0.547	0.	0.230	0.230	0.074	0.074
2	10.00	18.4	11.8	10.4	0.533	0.	0.220	0.220	0.070	0.070
3	15.00	15.5	9.2	9.8	0.514	0.	0.211	0.211	0.065	0.065
4	30.00	12.1	6.5	9.5	0.482	0.	0.173	0.173	0.050	0.050
5	50.00	11.9	7.3	9.0	0.470	0.	0.114	0.114	0.030	0.030
6	70.00	7.2	3.8	10.1	0.423	0.	0.072	0.072	0.017	0.017
7	85.00	2.9	0.2	14.3	0.441	0.	0.140	0.140	0.030	0.030
8	90.00	1.9	-0.5	15.3	0.452	0.	0.169	0.169	0.035	0.035
9	95.00	2.3	0.1	12.2	0.477	0.	0.187	0.187	0.038	0.038

TABLE XV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(u) 60 Percent of design speed; reading 3175

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	22.959	22.969	58.7	1.5	58.7	1.5	306.5	0.992	11.58	0.977
2	22.484	22.504	54.7	2.3	54.7	2.3	305.6	0.993	11.68	0.970
3	22.004	22.027	50.7	2.3	50.7	2.3	304.4	0.994	11.68	0.973
4	20.559	20.587	43.7	1.5	43.7	1.5	302.1	0.997	11.65	0.984
5	18.639	18.702	41.7	1.7	41.7	1.7	300.9	1.000	11.68	0.992
6	16.723	16.883	43.7	1.9	43.7	1.9	301.4	1.000	11.78	0.990
7	15.286	15.585	46.9	3.9	46.9	3.9	302.8	0.999	11.91	0.974
8	14.803	15.174	48.9	4.1	48.9	4.1	303.4	0.998	11.94	0.969
9	14.318	14.773	51.6	1.3	51.6	1.3	303.8	0.998	11.85	0.972

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	114.3	77.4	114.3	77.4	59.3	77.3	97.7	2.0	0.	0.
2	125.8	80.1	125.8	80.1	72.6	80.1	102.7	3.2	0.	0.
3	128.3	85.2	128.3	85.2	81.3	85.1	99.2	3.4	0.	0.
4	128.5	93.0	128.5	93.0	92.9	92.9	88.8	2.4	0.	0.
5	136.4	104.4	136.4	104.4	101.8	104.3	90.6	3.1	0.	0.
6	148.3	111.7	148.3	111.7	107.2	111.6	102.6	3.7	0.	0.
7	161.4	110.1	161.4	110.1	110.4	109.9	117.8	7.5	0.	0.
8	164.9	110.3	164.9	110.3	108.4	110.0	124.2	7.9	0.	0.
9	163.0	109.0	163.0	109.0	101.4	108.9	127.7	2.4	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		TOTAL LOSS	MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	COEFF, WAKE	VEL R	MACH NO
1	0.329	0.222	0.329	0.222	0.171	0.222	0.083	1.303	0.735
2	0.364	0.231	0.364	0.231	0.210	0.231	0.139	1.103	0.763
3	0.372	0.240	0.372	0.240	0.236	0.240	0.065	1.023	0.728
4	0.374	0.269	0.374	0.269	0.270	0.269	0.125	1.000	0.629
5	0.398	0.303	0.398	0.303	0.297	0.303	0.114	1.025	0.612
6	0.434	0.324	0.434	0.324	0.314	0.324	0.096	1.041	0.621
7	0.473	0.319	0.473	0.319	0.323	0.318	0.121	0.996	0.650
8	0.483	0.319	0.483	0.319	0.318	0.319	0.119	1.015	0.662
9	0.477	0.315	0.477	0.315	0.297	0.315	0.120	1.075	0.657

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	24.7	18.0	10.4	0.594	0.	0.319	0.319	0.103	0.103
2	10.00	22.4	15.9	10.6	0.613	0.	0.348	0.348	0.110	0.110
3	15.00	19.3	13.0	10.1	0.563	0.	0.299	0.299	0.092	0.092
4	30.00	12.0	6.5	9.0	0.471	0.	0.170	0.170	0.049	0.049
5	50.00	7.7	3.2	9.7	0.404	0.	0.079	0.079	0.021	0.021
6	70.00	5.7	2.2	10.7	0.404	0.	0.082	0.082	0.019	0.019
7	85.00	4.1	1.4	13.5	0.484	0.	0.183	0.183	0.040	0.040
8	90.00	3.8	1.4	14.1	0.477	0.	0.208	0.208	0.044	0.044
9	95.00	3.7	1.5	11.9	0.485	0.	0.195	0.195	0.040	0.040

TABLE XV. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9D

(v) 50 Percent of design speed; reading 3176

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.959	22.969	51.3	3.7	51.3	3.7	301.0	0.999	11.18	0.989
2	22.484	22.504	47.8	4.2	47.8	4.2	300.5	0.999	11.20	0.990
3	22.004	22.027	44.2	3.2	44.2	3.2	300.0	1.000	11.21	0.990
4	20.559	20.587	42.3	2.3	42.3	2.3	299.1	1.000	11.23	0.991
5	18.639	18.702	45.3	1.2	45.3	1.2	298.6	1.000	11.21	0.995
6	16.723	16.883	46.2	1.2	46.2	1.2	298.7	0.999	11.30	0.995
7	15.286	15.585	47.1	4.7	47.1	4.7	298.7	1.000	11.38	0.988
8	14.803	15.174	48.0	5.3	48.0	5.3	298.9	1.000	11.43	0.983
9	14.318	14.773	50.9	1.3	50.9	1.3	299.2	0.999	11.37	0.981

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	97.4	71.2	97.4	71.2	60.9	71.1	76.0	4.6	0.	0.
2	100.3	73.7	100.3	73.7	67.4	73.5	74.3	5.5	0.	0.
3	102.9	75.9	102.9	75.9	73.7	75.8	71.8	4.2	0.	0.
4	107.3	80.1	107.3	80.1	79.4	80.1	72.2	3.2	0.	0.
5	111.6	83.6	111.6	83.6	78.5	83.6	79.3	1.8	0.	0.
6	122.2	92.8	122.2	92.8	84.6	92.8	88.1	1.9	0.	0.
7	132.4	94.6	132.4	94.6	90.2	94.2	96.9	7.8	0.	0.
8	136.5	94.3	136.5	94.3	91.3	93.9	101.5	8.7	0.	0.
9	135.5	91.2	135.5	91.2	85.5	91.2	105.1	2.1	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.282	0.206	0.282	0.206	0.177	0.205	0.220	1.167	0.552
2	0.291	0.213	0.291	0.213	0.196	0.213	0.106	1.090	0.538
3	0.299	0.220	0.299	0.220	0.214	0.219	0.104	1.028	0.518
4	0.313	0.232	0.313	0.232	0.231	0.232	0.185	1.009	0.511
5	0.325	0.243	0.325	0.243	0.229	0.243	0.086	1.065	0.531
6	0.357	0.270	0.357	0.270	0.247	0.270	0.072	1.096	0.540
7	0.388	0.275	0.388	0.275	0.264	0.274	0.124	1.045	0.536
8	0.400	0.274	0.400	0.274	0.268	0.273	0.113	1.029	0.536
9	0.397	0.265	0.397	0.265	0.250	0.265	0.118	1.067	0.537

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	17.2	10.5	12.7	0.505	0.	0.197	0.197	0.064	0.064
2	10.00	15.4	8.9	12.5	0.482	0.	0.176	0.176	0.056	0.056
3	15.00	12.9	6.6	11.0	0.465	0.	0.162	0.162	0.050	0.050
4	30.00	10.6	5.0	9.8	0.439	0.	0.130	0.130	0.038	0.038
5	50.00	11.3	6.7	9.3	0.433	0.	0.076	0.076	0.020	0.020
6	70.00	8.1	4.7	10.0	0.407	0.	0.053	0.053	0.013	0.013
7	85.00	4.2	1.6	14.4	0.430	0.	0.117	0.117	0.025	0.025
8	90.00	2.9	0.5	15.4	0.450	0.	0.167	0.167	0.035	0.035
9	95.00	3.0	0.9	11.9	0.479	0.	0.180	0.180	0.037	0.037

TABLE XVI. - BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9R[a]

(a) 100 Percent of design speed; reading 704

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.949	22.944	33.0	12.6	33.0	12.6	329.0	0.986	14.55	0.961
2	22.479	22.474	31.3	9.4	31.3	9.4	328.0	1.000	15.05	0.977
3	22.004	21.999	31.3	7.6	31.3	7.6	327.4	1.000	15.16	0.985
4	20.577	20.574	33.2	7.7	33.2	7.7	327.3	0.999	15.20	0.983
5	18.682	18.717	36.2	7.4	36.2	7.4	326.9	1.004	15.29	0.989
6	16.787	16.916	39.6	5.0	39.6	5.0	327.5	1.001	15.37	0.983
7	15.342	15.624	44.6	5.7	44.6	5.7	330.0	0.998	15.68	0.972
8	14.849	15.164	47.1	7.6	47.1	7.6	330.8	0.996	15.59	0.958
9	14.343	14.684	51.0	9.2	51.0	9.2	330.0	0.998	14.75	0.955

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	235.6	186.7	235.6	186.7	197.7	182.2	128.2	40.9	0.	0.
2	250.5	209.3	250.5	209.3	214.0	206.5	130.3	34.4	0.	0.
3	254.7	214.2	254.7	214.2	217.6	212.3	132.4	28.4	0.	0.
4	263.9	209.1	263.9	209.1	220.9	207.2	144.4	28.2	0.	0.
5	277.3	212.1	277.3	212.1	223.9	210.3	163.7	27.4	0.	0.
6	287.3	212.3	287.3	212.3	221.5	211.5	182.9	18.4	0.	0.
7	295.2	217.7	295.2	217.7	210.0	216.6	207.4	21.6	0.	0.
8	291.9	211.1	291.9	211.1	198.7	209.3	213.9	28.0	0.	0.
9	274.5	188.6	274.5	188.6	172.7	186.2	213.3	30.2	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.677	0.532	0.677	0.532	0.568	0.519	0.097	0.922	0.994
2	0.726	0.597	0.726	0.597	0.620	0.589	0.050	0.965	1.022
3	0.740	0.612	0.740	0.612	0.632	0.607	0.039	0.976	1.038
4	0.770	0.597	0.770	0.597	0.644	0.592	0.052	0.938	1.109
5	0.814	0.605	0.814	0.605	0.657	0.600	0.057	0.940	1.212
6	0.847	0.606	0.847	0.606	0.653	0.604	0.049	0.955	1.288
7	0.870	0.621	0.870	0.621	0.619	0.618	0.051	1.031	1.387
8	0.858	0.601	0.858	0.601	0.584	0.596	0.070	1.053	1.407
9	0.801	0.533	0.801	0.533	0.504	0.526	0.106	1.078	1.389

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	8.0	-6.1	13.8	0.337	0.	0.148	0.145	0.050	0.049
2	10.00	8.1	-6.2	10.2	0.295	0.	0.078	0.075	0.026	0.025
3	15.00	9.0	-5.3	8.2	0.295	0.	0.048	0.046	0.016	0.015
4	30.00	9.2	-3.9	8.5	0.346	0.	0.054	0.051	0.017	0.016
5	50.00	7.6	-3.6	8.9	0.375	0.	0.033	0.030	0.009	0.008
6	70.00	5.0	-4.4	7.2	0.407	0.	0.045	0.042	0.011	0.011
7	85.00	3.6	-4.4	8.8	0.408	0.	0.071	0.069	0.017	0.016
8	90.00	3.8	-3.8	11.0	0.418	0.	0.109	0.107	0.024	0.024
9	95.00	5.5	-1.7	12.9	0.455	0.	0.131	0.129	0.028	0.028

[a] Corrected data; see ref. 4.

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TABLE XVI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9R

100 Percent of design speed; reading 709

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.949	22.944	39.1	12.5	39.1	12.5	336.4	0.997	15.54	0.959
2	22.479	22.474	37.2	10.6	37.2	10.6	334.3	1.000	15.83	0.974
3	22.004	21.999	36.8	8.9	36.8	8.9	333.0	0.999	15.89	0.978
4	20.577	20.574	37.6	8.6	37.6	8.6	330.6	1.001	15.70	0.982
5	18.602	18.717	36.3	7.3	36.3	7.3	327.1	1.005	15.33	0.990
6	16.787	16.916	39.6	5.3	39.6	5.3	327.7	1.001	15.45	0.983
7	15.342	15.624	44.9	5.9	44.9	5.9	330.3	0.998	15.68	0.975
8	14.849	15.164	47.2	7.8	47.2	7.8	331.2	0.996	15.66	0.955
9	14.343	14.684	51.7	9.3	51.7	9.3	330.2	0.998	14.54	0.972

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	236.6	181.5	236.6	181.5	183.7	177.2	149.1	39.3	0.	0.
2	245.9	196.8	245.9	196.8	196.0	193.4	148.5	36.3	0.	0.
3	249.2	199.5	249.2	199.5	199.5	197.1	149.3	31.0	0.	0.
4	255.0	192.8	255.0	192.8	202.0	190.7	155.6	28.8	0.	0.
5	275.3	208.9	275.3	208.9	222.0	207.3	162.8	26.4	0.	0.
6	286.9	210.0	286.9	210.0	221.0	209.1	183.0	19.4	0.	0.
7	292.9	214.2	292.9	214.2	207.4	213.0	206.9	22.1	0.	0.
8	291.3	207.2	291.3	207.2	197.9	205.3	213.7	28.2	0.	0.
9	268.5	185.3	268.5	185.3	166.5	182.8	210.6	30.1	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.672	0.507	0.672	0.507	0.522	0.495	0.121	0.964	1.126
2	0.704	0.553	0.704	0.553	0.561	0.544	0.084	0.987	1.130
3	0.715	0.563	0.715	0.563	0.573	0.556	0.068	0.988	1.138
4	0.737	0.544	0.737	0.544	0.583	0.538	0.056	0.944	1.173
5	0.807	0.595	0.807	0.595	0.651	0.590	0.053	0.934	1.203
6	0.845	0.599	0.845	0.599	0.651	0.596	0.043	0.946	1.287
7	0.862	0.610	0.862	0.610	0.610	0.607	0.054	1.027	1.384
8	0.855	0.589	0.855	0.589	0.581	0.583	0.071	1.037	1.406
9	0.781	0.523	0.781	0.523	0.484	0.516	0.114	1.098	1.373

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	14.1	0.0	13.6	0.395	0.	0.158	0.156	0.054	0.053
2	10.00	14.0	-0.3	11.4	0.356	0.	0.093	0.092	0.031	0.031
3	15.00	14.5	0.2	9.5	0.358	0.	0.075	0.073	0.025	0.024
4	30.00	13.6	0.5	9.4	0.399	0.	0.060	0.058	0.018	0.018
5	50.00	7.7	-3.5	8.7	0.382	0.	0.028	0.026	0.008	0.007
6	70.00	5.1	-4.3	7.5	0.413	0.	0.046	0.045	0.012	0.011
7	85.00	3.9	-4.1	9.0	0.414	0.	0.065	0.064	0.015	0.015
8	90.00	3.9	-3.7	11.2	0.430	0.	0.118	0.116	0.026	0.026
9	95.00	6.2	-1.0	13.0	0.454	0.	0.085	0.084	0.018	0.018

TABLE XVI. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 9R

(c) 100 Percent of design speed; reading 707

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	22.949	22.944	40.6	12.7	40.6	12.7	335.9	0.998	15.09	0.964
2	22.479	22.474	38.7	10.7	38.7	10.7	334.2	0.999	15.50	0.961
3	22.004	21.999	38.2	9.4	38.2	9.4	332.8	0.999	15.57	0.964
4	20.577	20.574	40.0	9.1	40.0	9.1	330.7	1.000	15.26	0.977
5	18.682	18.717	42.6	8.2	42.6	8.2	329.1	1.000	15.12	0.971
6	16.787	16.916	44.8	7.5	44.8	7.5	329.0	1.000	15.15	0.976
7	15.342	15.624	47.4	7.7	47.4	7.7	330.4	0.996	15.59	0.953
8	14.849	15.164	49.4	9.5	49.4	9.5	330.7	0.996	15.57	0.941
9	14.343	14.684	52.9	9.9	52.9	9.9	330.3	0.997	14.65	0.963

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	228.3	176.4	228.3	176.4	173.3	172.1	148.6	38.6	0.	0.
2	238.2	187.7	238.2	187.7	185.8	184.5	149.0	34.9	0.	0.
3	241.0	189.1	241.0	189.1	189.5	186.6	148.9	30.9	0.	0.
4	245.1	182.6	245.1	182.6	187.8	180.3	157.5	28.8	0.	0.
5	251.7	175.5	251.7	175.5	185.2	173.7	170.4	25.1	0.	0.
6	264.2	180.2	264.2	180.2	187.3	178.7	186.3	23.6	0.	0.
7	280.1	187.1	280.1	187.1	189.6	185.4	206.1	25.2	0.	0.
8	280.1	182.3	280.1	182.3	182.3	179.8	212.7	30.1	0.	0.
9	262.6	165.9	262.6	165.9	158.6	163.4	209.3	28.4	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	TOTAL LOSS COEFF, WAKE	MERID VEL R	PEAK SS MACH NO
1	0.647	0.492	0.647	0.492	0.491	0.480	0.108	0.993	1.118
2	0.679	0.527	0.679	0.527	0.530	0.517	0.087	0.993	1.128
3	0.690	0.532	0.690	0.532	0.542	0.525	0.068	0.985	1.129
4	0.705	0.514	0.705	0.514	0.540	0.508	0.077	0.960	1.179
5	0.728	0.494	0.728	0.494	0.536	0.489	0.066	0.938	1.241
6	0.768	0.508	0.768	0.508	0.545	0.504	0.063	0.954	1.306
7	0.819	0.529	0.819	0.529	0.554	0.524	0.074	0.978	1.382
8	0.818	0.514	0.818	0.514	0.532	0.507	0.087	0.986	1.407
9	0.762	0.466	0.762	0.466	0.460	0.459	0.109	1.030	1.370

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	15.7	1.6	13.8	0.395	0.	0.147	0.146	0.050	0.050
2	10.00	15.5	1.2	11.5	0.376	0.	0.149	0.148	0.050	0.050
3	15.00	15.9	1.6	10.0	0.379	0.	0.131	0.130	0.043	0.043
4	30.00	16.0	2.9	9.9	0.419	0.	0.082	0.081	0.025	0.025
5	50.00	14.0	2.8	9.7	0.467	0.	0.097	0.096	0.027	0.027
6	70.00	10.3	0.9	9.8	0.475	0.	0.073	0.072	0.019	0.018
7	85.00	6.4	-1.7	10.8	0.481	0.	0.131	0.130	0.030	0.030
8	90.00	6.1	-1.5	12.8	0.494	0.	0.167	0.166	0.037	0.037
9	95.00	7.4	0.2	13.5	0.516	0.	0.117	0.116	0.025	0.025

TABLE XVII. - BLADE-ELEMENT TOTAL-LOSS COEFFICIENT

FOR STATOR S9[a]

(a) 100 Percent of design speed

RP	Reading							
	600		601		602		543	
	Total-loss coefficient, $\overline{\omega}$ or $\overline{\omega}_w$, based on data taken at station -							
	2b	3	2b	3	2b	3	2a	3
1	0.128	-----	0.115	-----	0.108	-----	0.239	-----
2	.061	0.056	.086	0.066	.146	0.109	.135	0.072
3	.048	-----	.067	-----	.147	-----	.119	-----
4	.074	.074	.052	.053	.111	.099	.085	.061
5	.094	.088	.050	.058	.052	.066	.075	.057
6	.089	.082	.052	.054	.063	.055	-----	-----
7	.110	-----	.079	-----	.119	-----	.079	-----
8	.110	.075	.140	.091	.144	.097	.136	.090
9	.148	-----	.126	-----	.148	-----	.226	-----

(b) 70 Percent of design speed

RP	Reading					
	573		550		574	
	Total-loss coefficient, $\overline{\omega}$ or $\overline{\omega}_w$, based on data taken at station -					
	2a	3	2a	3	2a	3
1	0.202	-----	0.353	-----	0.198	-----
2	.061	0.030	.370	0.097	.064	0.033
3	.041	-----	.365	-----	.045	-----
4	.047	.026	.258	.114	.050	.031
5	.054	.035	.187	.110	.051	.036
6	.051	.038	.098	.101	.034	.045
7	.086	-----	.174	-----	.073	-----
8	.073	.053	.219	.112	.073	.058
9	.134	-----	.217	-----	.160	-----

[a] See ref. 4 for other blade-element data for this stator.

TABLE XVIII. - BLADE-ELEMENT TOTAL-LOSS COEFFICIENT FOR STATOR S9R[a]

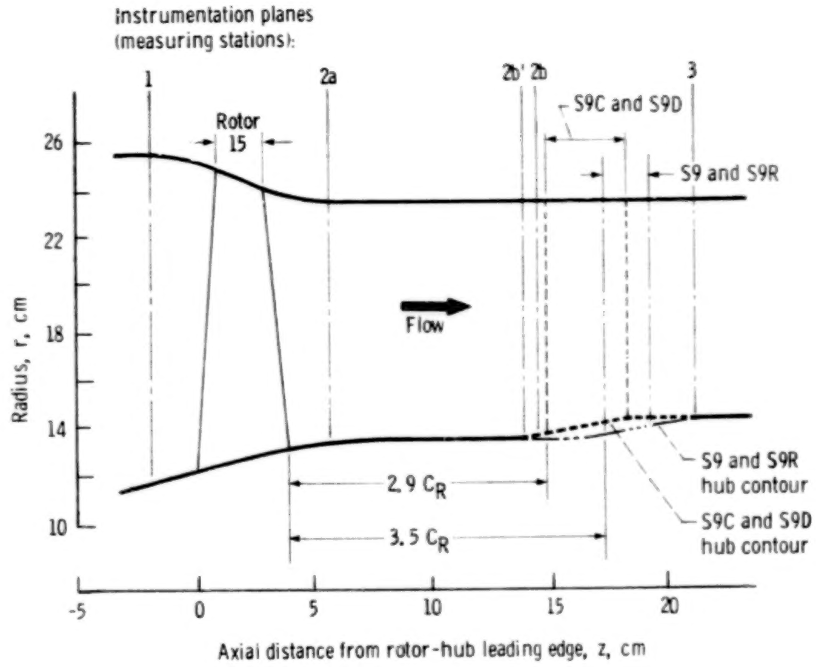
(a) 100 Percent of design speed

RP	Reading									
	678		704		709		684		707	
	Total-loss coefficient, $\bar{\omega}$ or $\bar{\omega}_w$, based on data taken at station -									
	2a	3	2b	3	2b	3	2a	3	2b	3
1	0.235	-----	0.148	0.097	0.158	0.121	0.232	-----	0.147	0.108
2	.098	0.057	.078	.050	.093	.084	.136	0.078	.149	.087
3	.097	-----	.048	.039	.075	.068	.082	-----	.131	.068
4	.143	.086	.054	.052	.060	.056	.078	.062	.082	.077
5	.139	.089	.033	.057	.028	.053	.066	.047	.097	.066
6	.174	.087	.045	.049	.046	.043	.047	.037	.073	.063
7	.164	-----	.071	.051	.065	.054	.064	-----	.131	.074
8	.123	.089	.109	.070	.118	.071	.166	.077	.167	.087
9	.276	-----	.131	.106	.085	.114	.278	-----	.117	.109

(b) 70 Percent of design speed

RP	Reading			
	693		694	
	Total-loss coefficient, $\bar{\omega}$ or $\bar{\omega}_w$, based on data taken at station -			
	2a	3	2a	3
1	0.194	-----	0.186	-----
2	.073	0.037	.062	0.023
3	.043	-----	.039	-----
4	.052	.040	.053	.031
5	.062	.050	.049	.037
6	.057	.053	.035	.038
7	.096	-----	.044	-----
8	.071	.069	.056	.052
9	.151	-----	.220	-----

[a] See ref. 4 for other blade-element data for this stator.

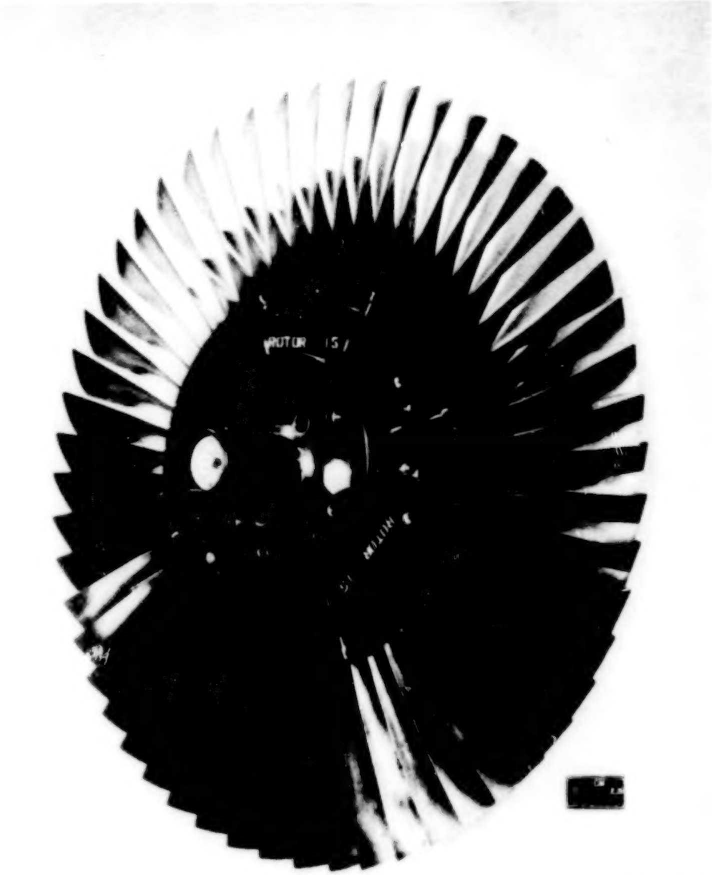

Instrumentation planes (measuring stations):
1
2a
2b'
2b
3
Rotor 15
S9C and S9D
S9 and S9R
Flow
S9 and S9R hub contour
S9C and S9D hub contour
2.9 C_R
3.5 C_R
26
22
18
14
10
Radius, r, cm
-5
0
5
10
15
20
Axial distance from rotor-hub leading edge, z, cm

Flow path coordinates

Axial distance, Z, cm	Radius, r, cm	
	Inner	Outer
-10.183	9.611	25.412
-5.365	10.909	25.412
-3.300	11.468	25.412
[a]-1.916	11.843	25.385
-1.235	12.027	25.311
.314	12.443	24.917
3.411	13.132	23.792
4.961	13.365	23.528
[a]5.628	13.437	23.475
7.025	13.503	23.426
10.467	13.597	23.421
[a]13.804	13.600	↓
13.908	13.600	
[a]14.439	13.600	
15.974	13.652	
17.350	13.764	
19.278	14.145	
[a]21.122	14.369	
21.480	14.381	
24.919	14.389	
28.364	14.389	

[a] Instrumentation survey plane.

Figure 1. - Flow path for stages showing axial locations of blading and instrumentation.



C-72-1781

Figure 2. - Rotor 15.

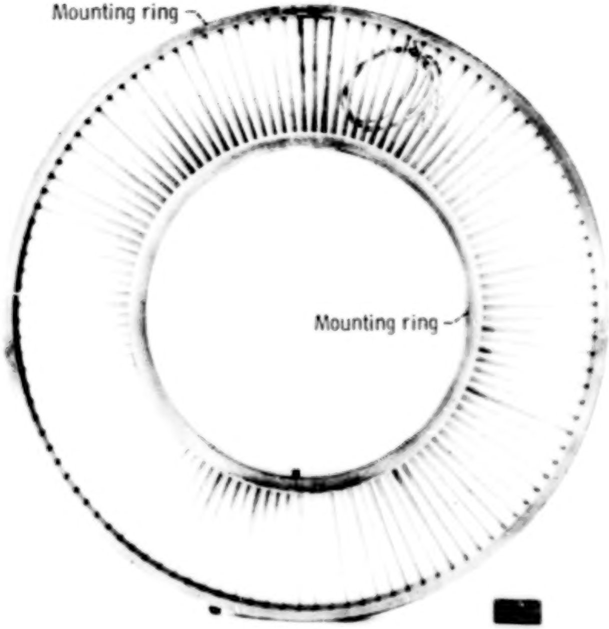
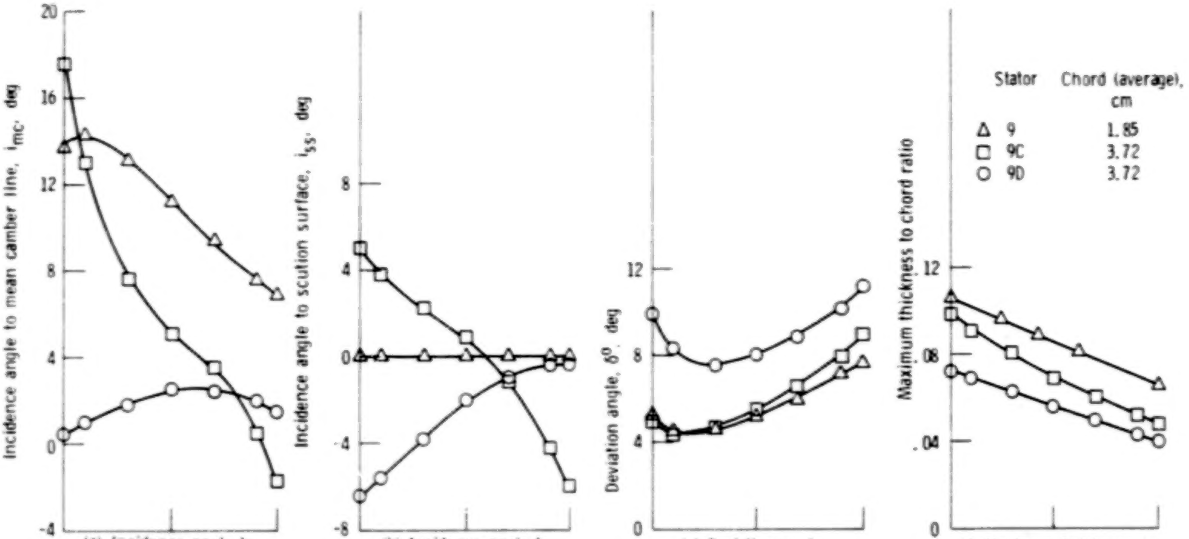

Mounting ring
Mounting ring

Figure 3. - Stator 9 (looking downstream).

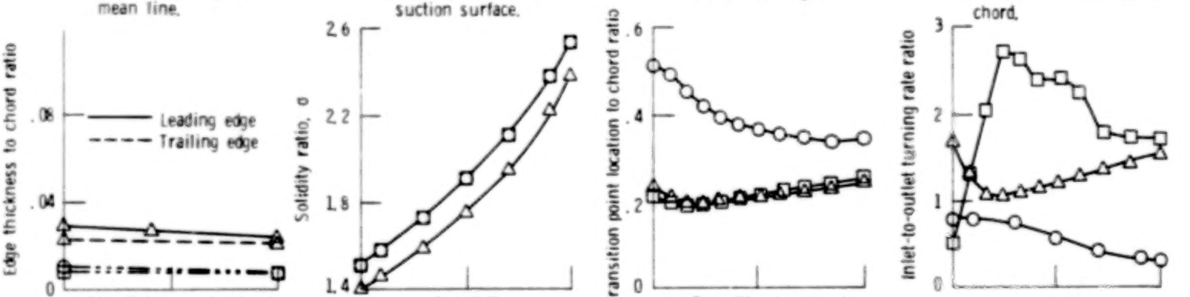


(a) Incidence angle to mean line.

(b) Incidence angle to suction surface.

(c) Deviation angle.

(d) Maximum thickness to chord.

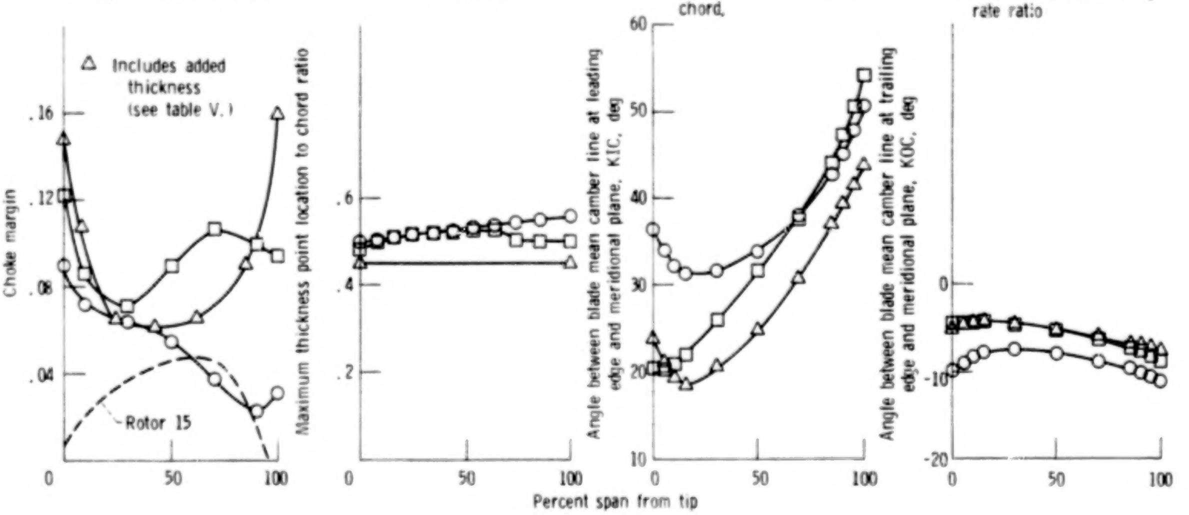


(e) Edge thickness to chord.

(f) Solidity.

(g) Transition location to chord.

(h) Inlet to outlet turning rate ratio



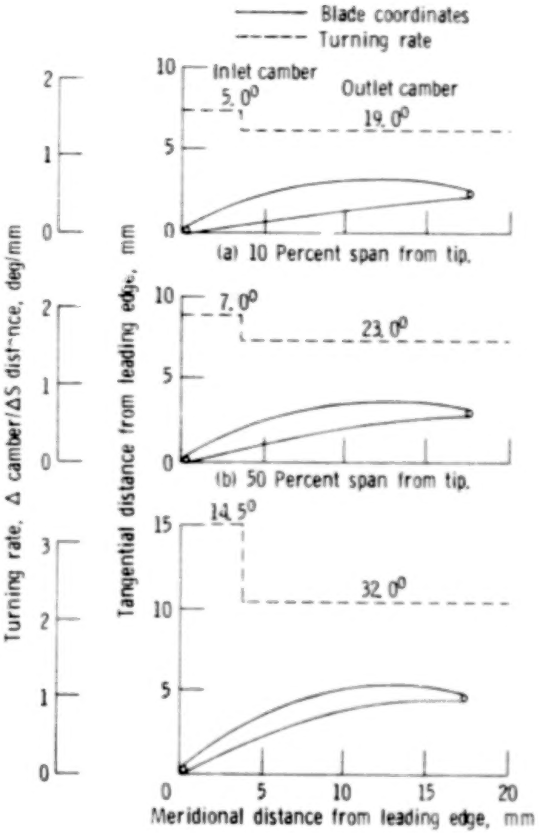
(i) Choke margin.

(j) Maximum thickness location.

(k) Blade inlet metal angle.

(l) Blade outlet metal angle.

Figure 4. - Radial distribution of design parameters for stators S9, S9C, and S9D.



(a) 10 Percent span from tip.

(b) 50 Percent span from tip.

(c) 90 Percent span from tip.

Figure 5. - Stator 9 coordinates and camber distributions near hub, mean, and tip sections.

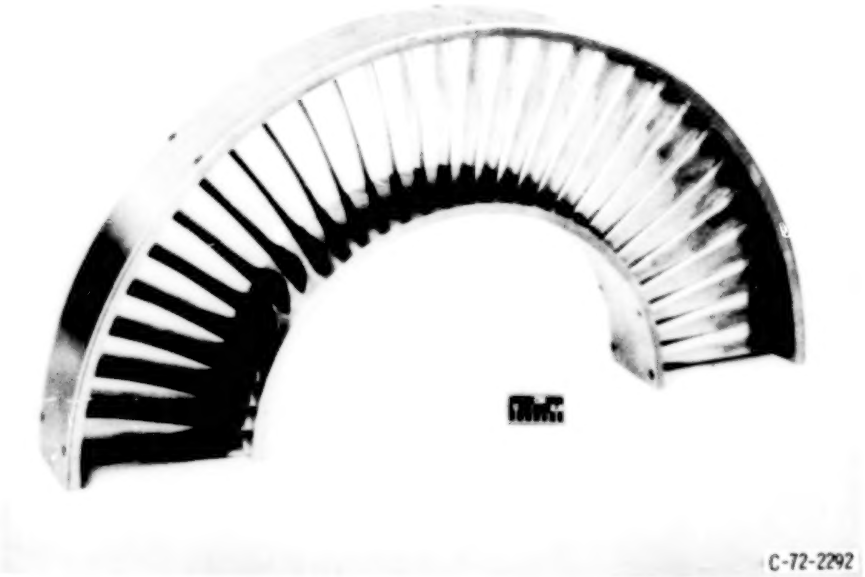
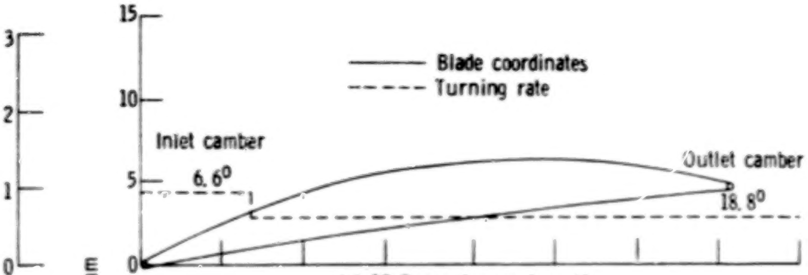
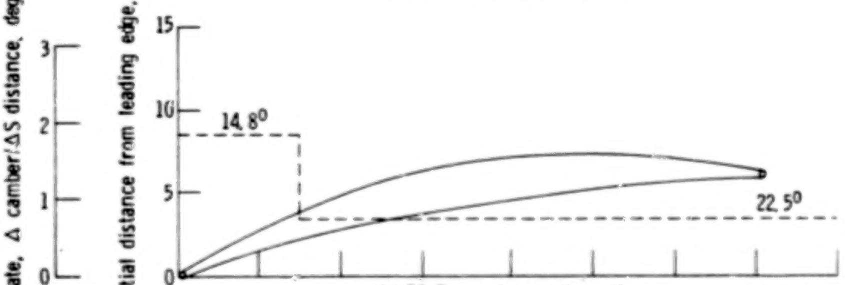


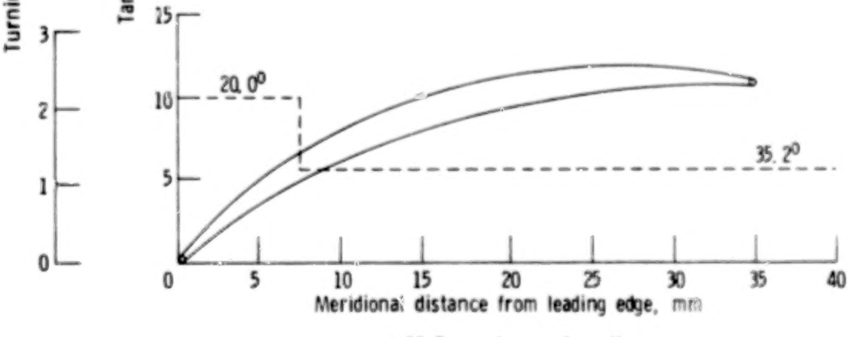
Figure 6. - Stator 9C (one-half of assembly).



(a) 10 Percent span from tip.



(b) 50 Percent span from tip.



(c) 90 Percent span from tip.

Figure 7. - Stator 9C coordinates and camber distributions near hub, mean, and tip sections.

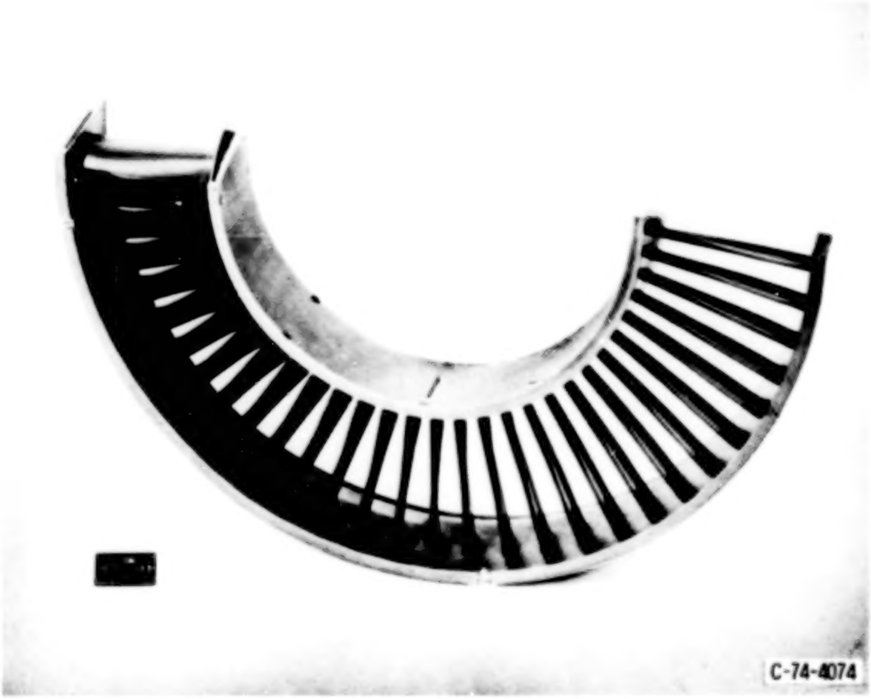
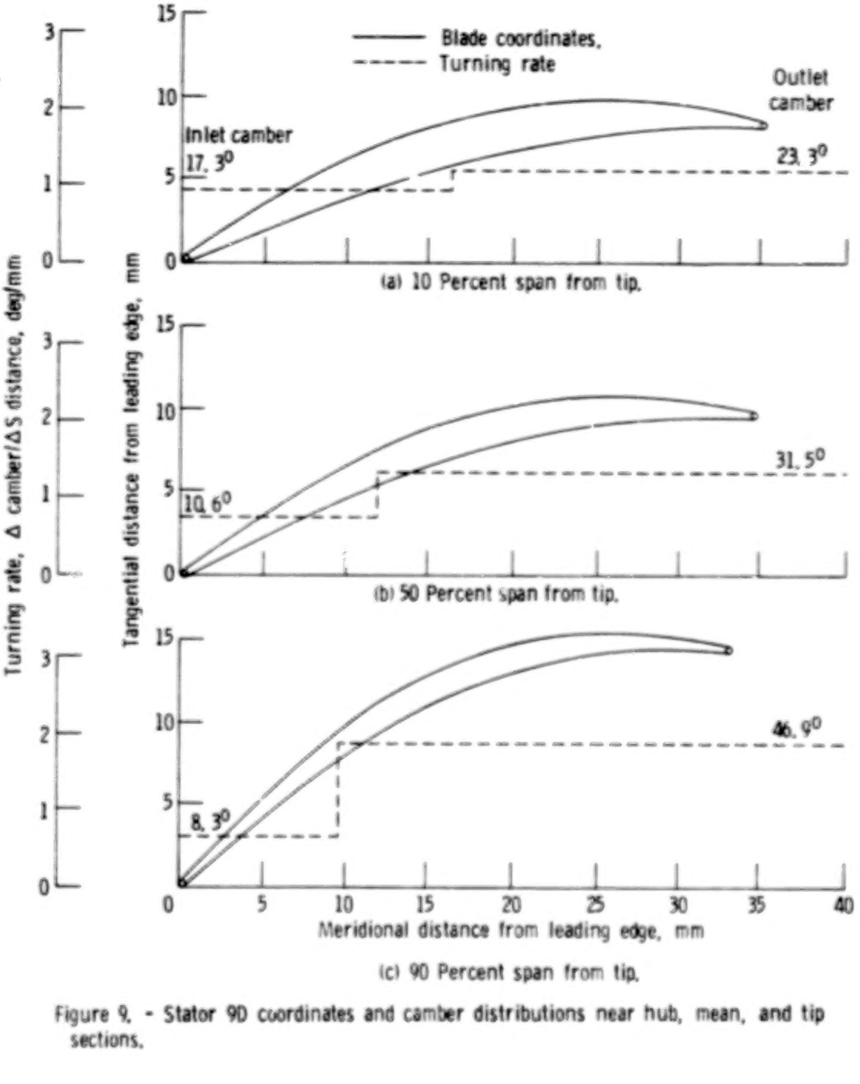


Figure 8. - Stator 9D (one-half of assembly).



(c) 90 Percent span from tip.

Figure 9. - Stator 9D coordinates and camber distributions near hub, mean, and tip sections.

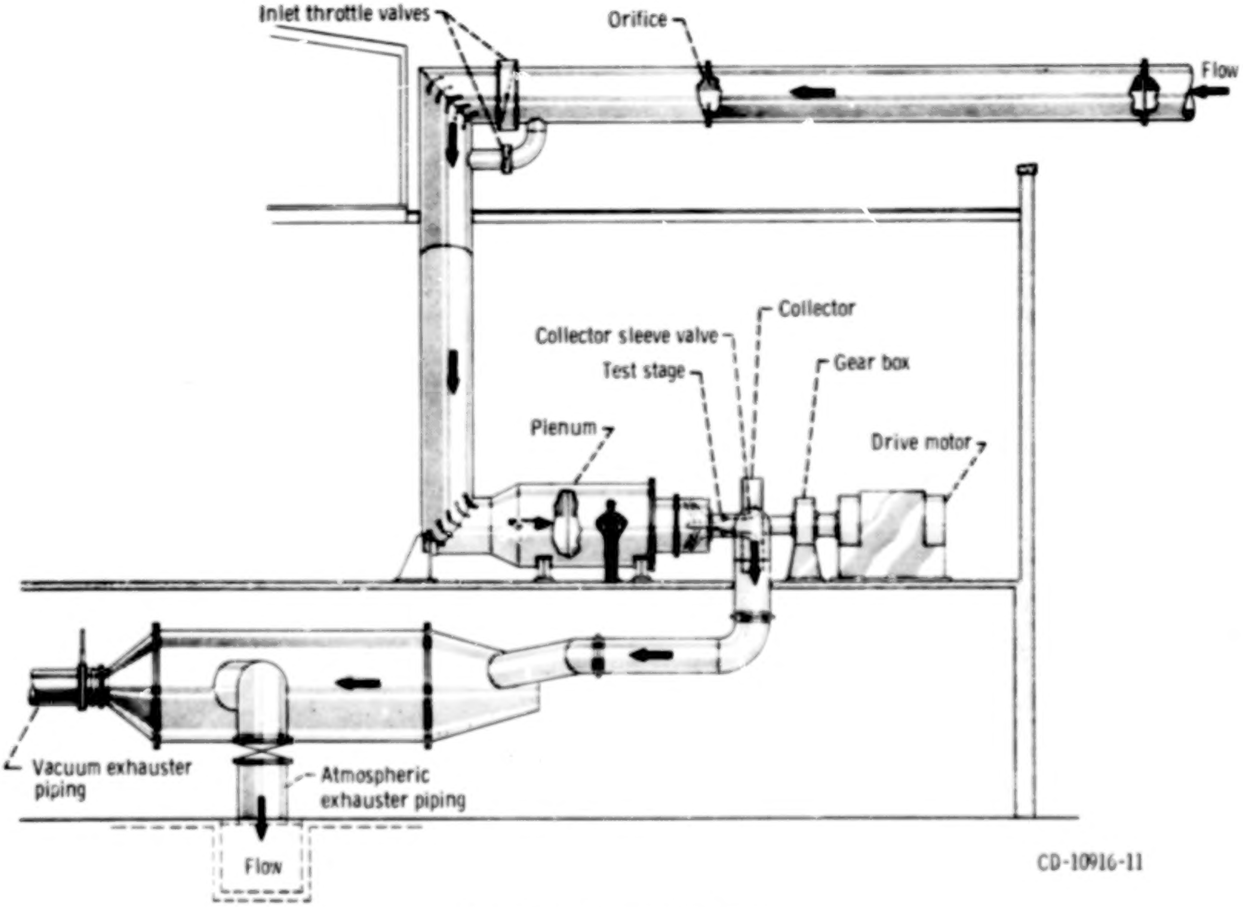
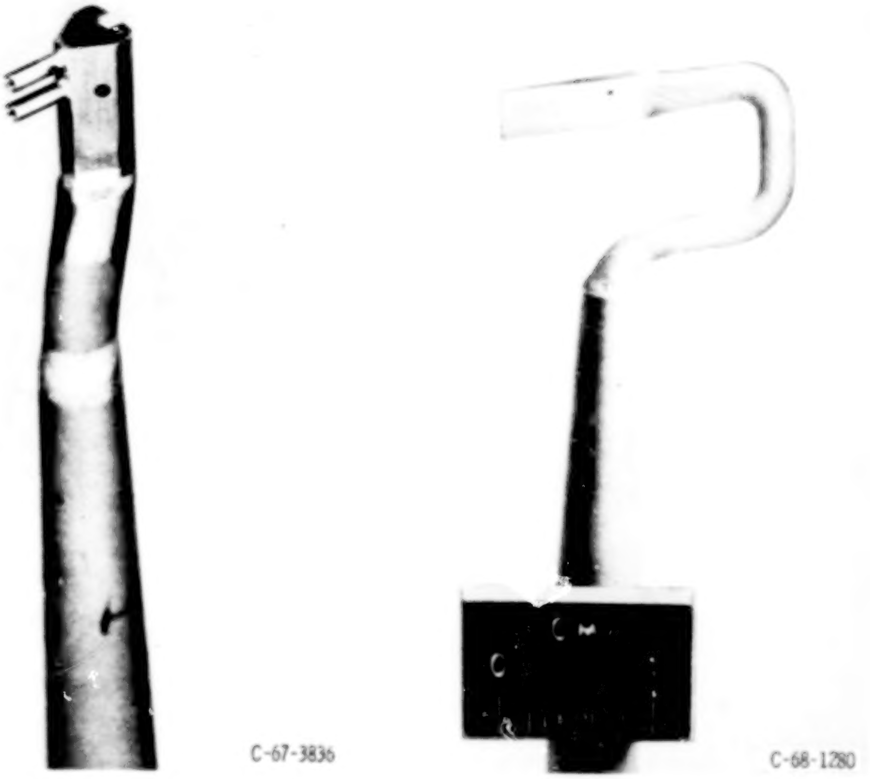
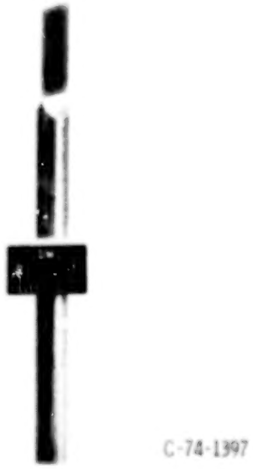

Inlet throttle valves
Orifice
Flow
Collector
Collector sleeve valve
Test stage
Gear box
Plenum
Drive motor
Vacuum exhauster piping
Atmospheric exhauster piping
Flow
CD-10916-11

Figure 10. - Compressor test facility.


C-67-3836
C-68-1280

(a) Combination total pressure, total temperature, and flow angle probe (double barrel probe).

(b) 8° Wedge static pressure probe.



(c) 18° Wedge static-pressure probe.

Figure 11. - Sensing probes.

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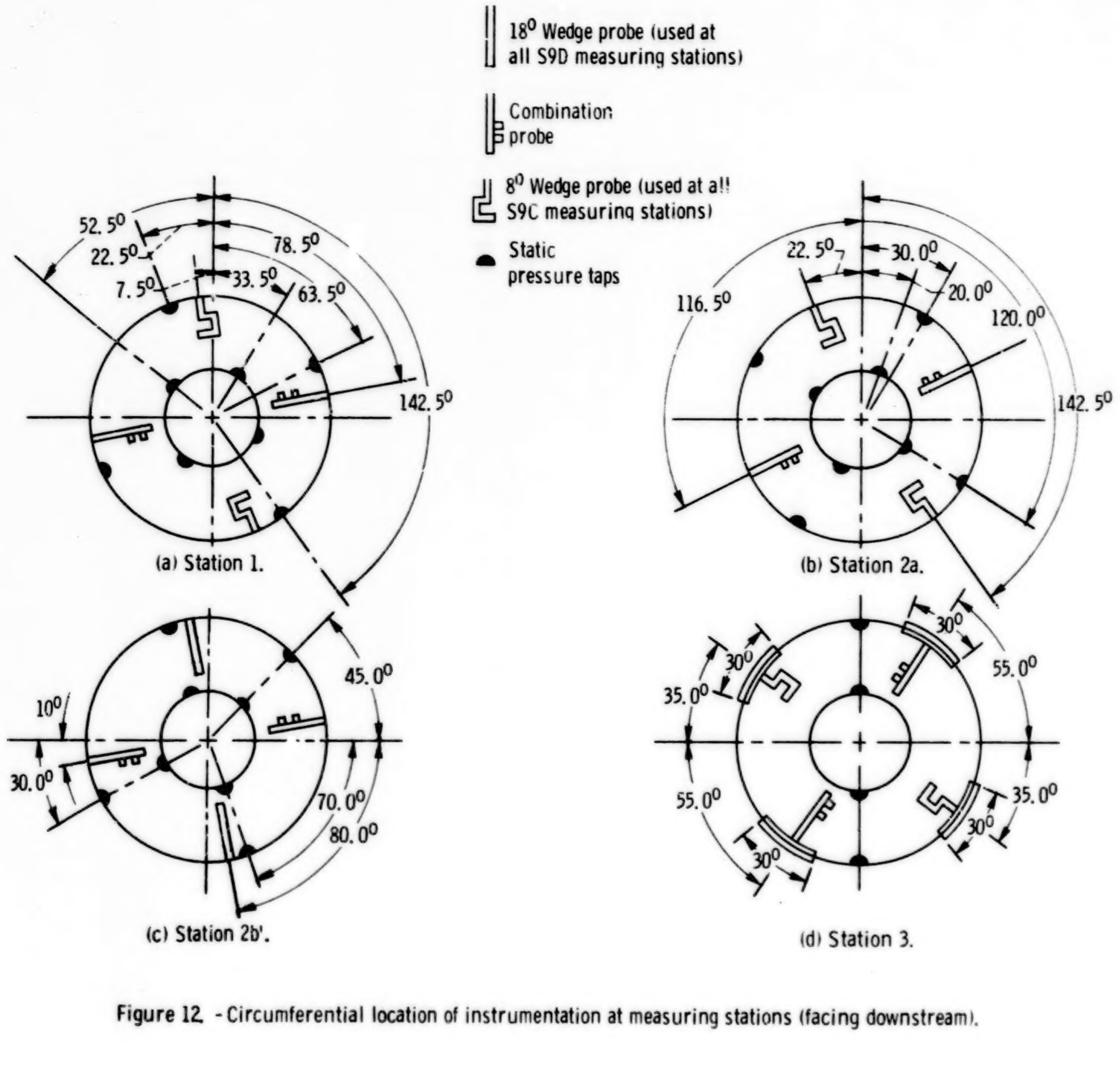

18° Wedge probe (used at all S9D measuring stations)
Combination probe
8° Wedge probe (used at all S9C measuring stations)
Static pressure taps
52.5°
22.5°
7.5°
33.5°
78.5°
63.5°
142.5°
22.5°
30.0°
20.0°
116.5°
120.0°
142.5°
45.0°
10°
30.0°
70.0°
80.0°
30°
30°
35.0°
55.0°
55.0°
30°
30°
35.0°

(a) Station 1.

(b) Station 2a.

(c) Station 2b'.

(d) Station 3.

Figure 12. - Circumferential location of instrumentation at measuring stations (facing downstream).

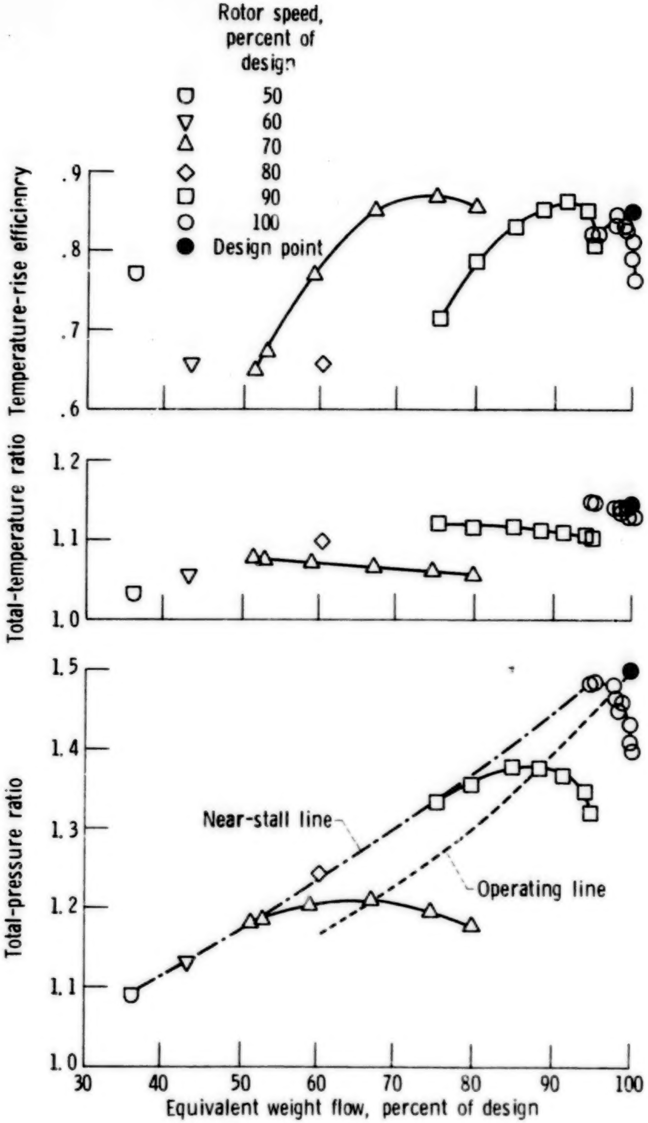


Figure 13. - Overall performance for stage 15-9.

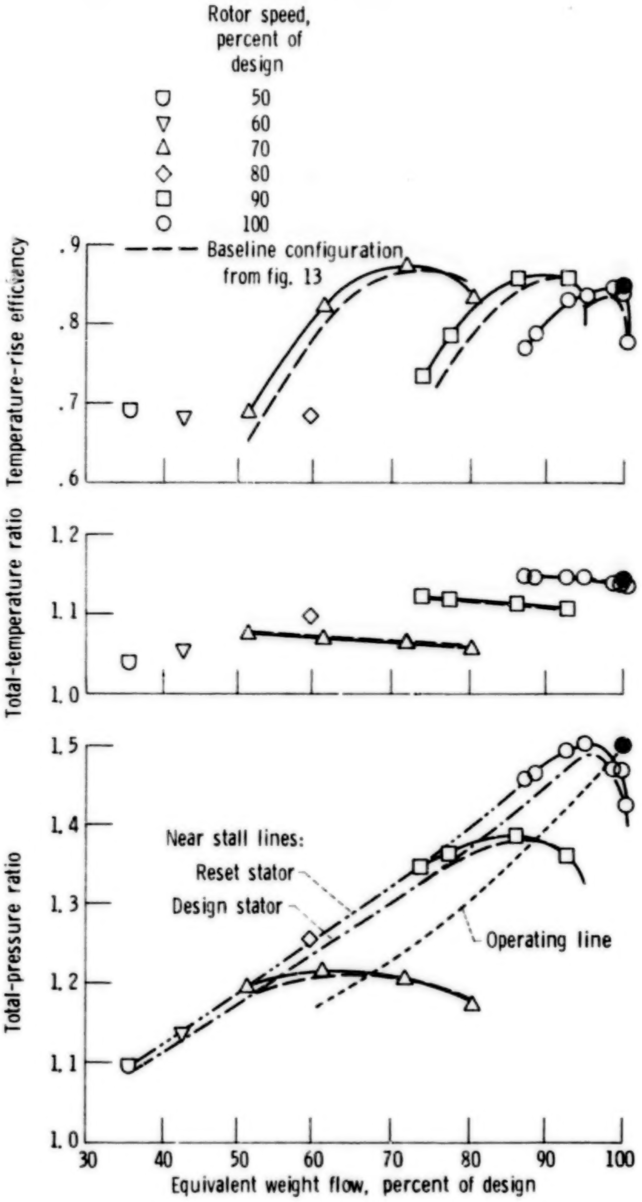


Figure 14. - Overall performance for stage 15-9R.

94

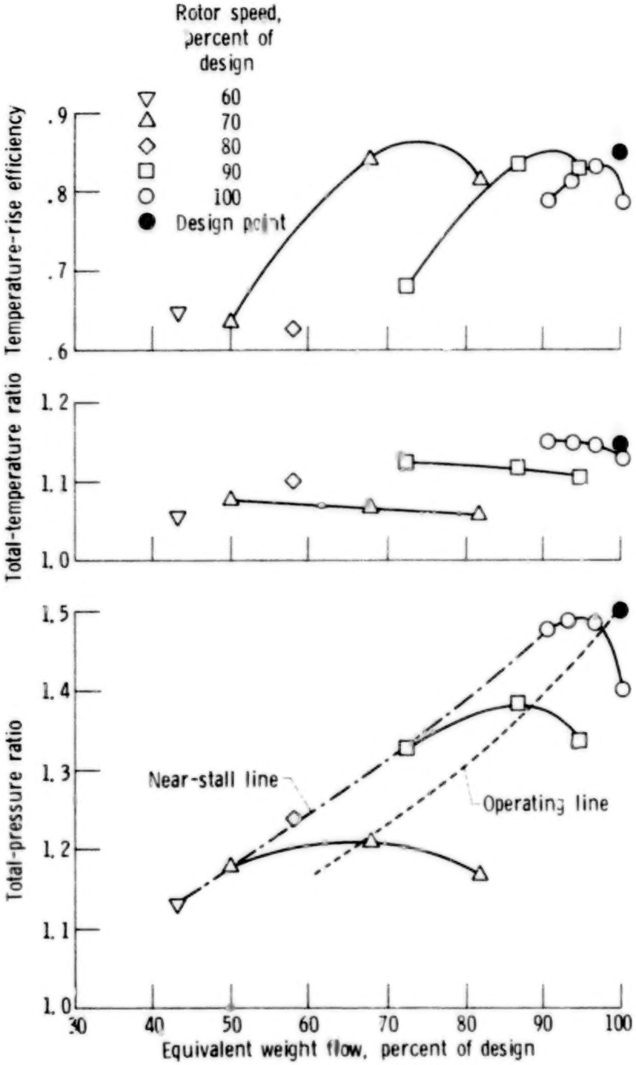


Figure 15. - Overall performance for stage 15-9C.

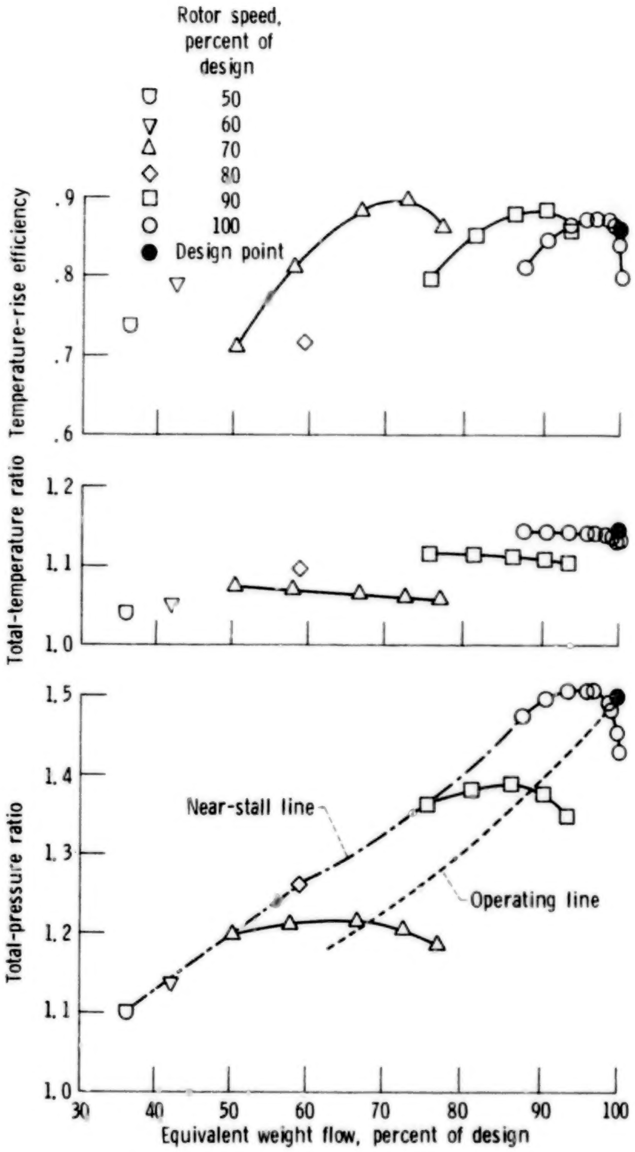
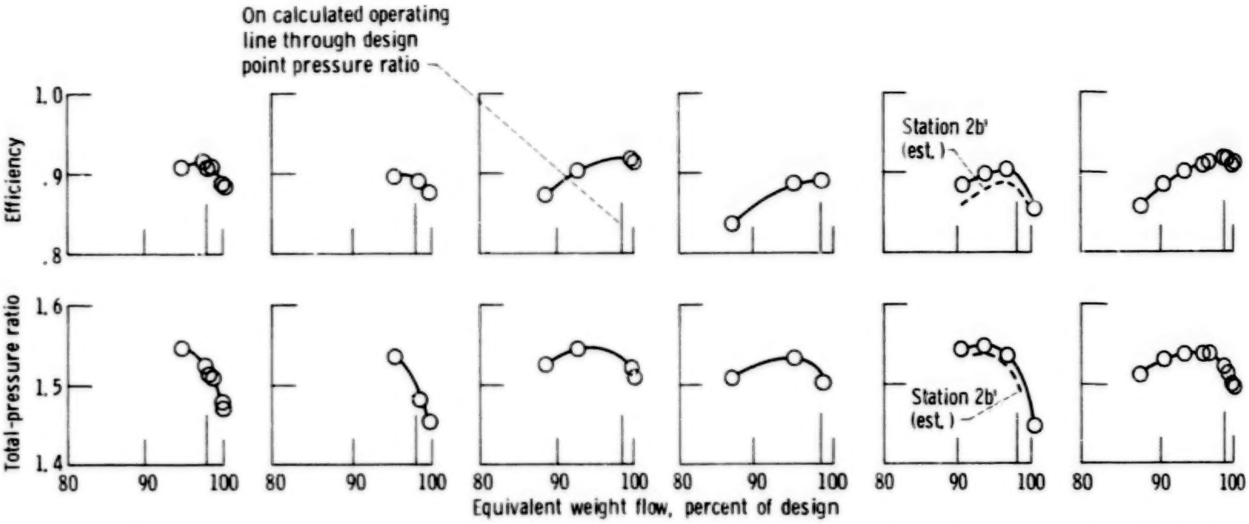


Figure 16. - Overall performance for stage 15-9D.



(a) Stator 9 per station 2a.

(b) Stator 9 per station 2b.

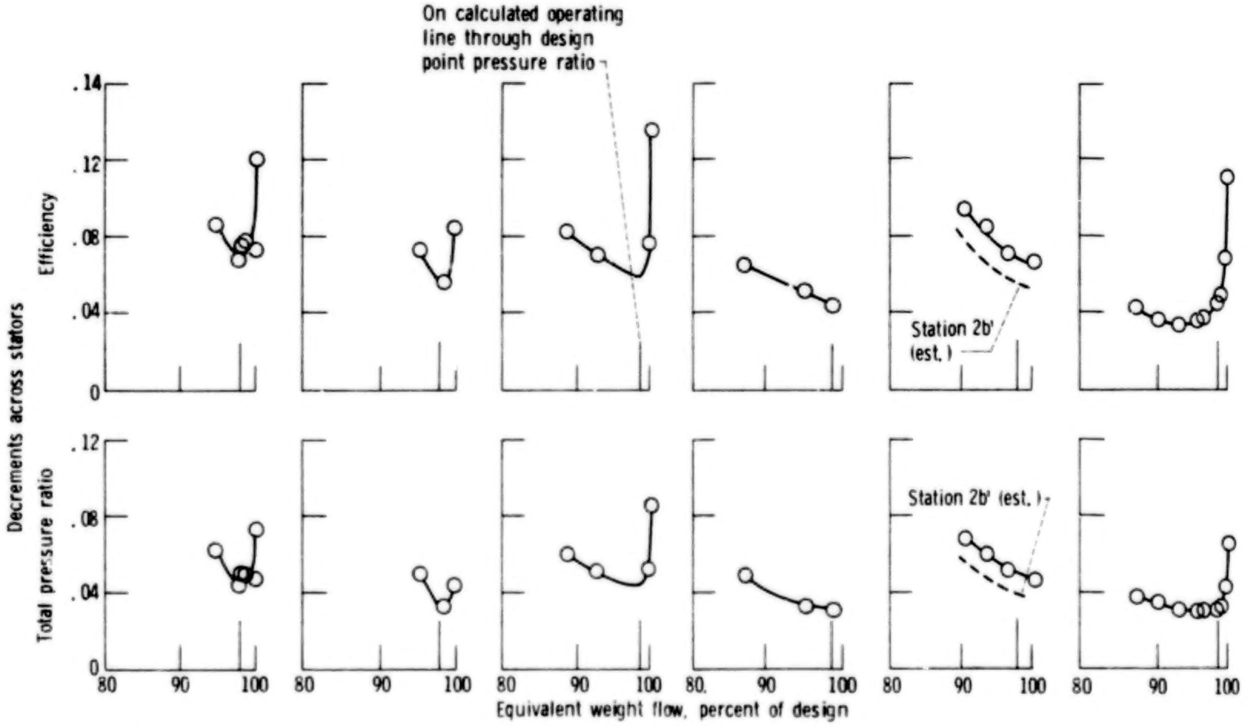
(c) Stator 9R per station 2a.

(d) Stator 9R per station 2b.

(e) Stator 9C per station 2a.

(f) Stator 9D per station 2b.

Figure 17. - Comparison of overall performance of rotor 15 operating with various stators at design speed.



(a) Stator 9 per station 2a.

(b) Stator 9 per station 2b.

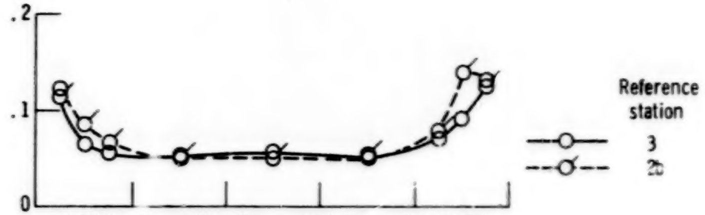
(c) Stator 9R per station 2a.

(d) Stator 9R per station 2b.

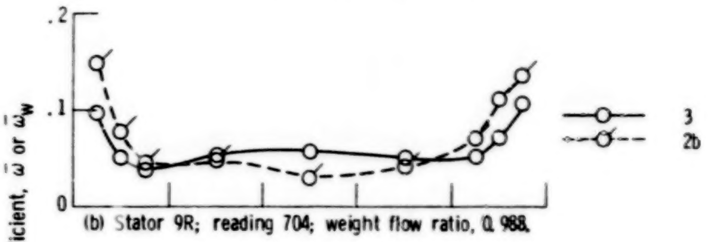
(e) Stator 9C per station 2a.

(f) Stator 9D per station 2b'.

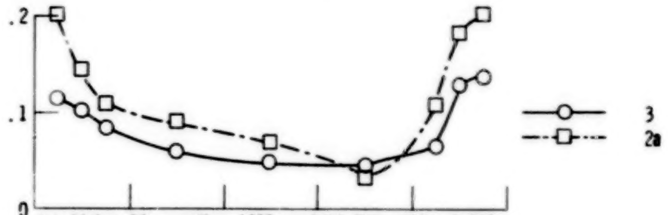
Figure 18. - Comparison of overall performance of various stators operating with rotor 15 at design speed.



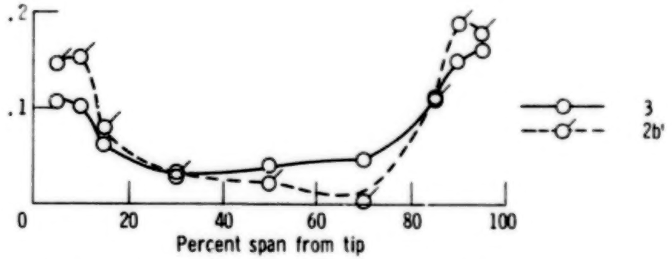
(a) Stator 9; reading 601; weight flow ratio, 0.985.



(b) Stator 9R; reading 704; weight flow ratio, 0.988.

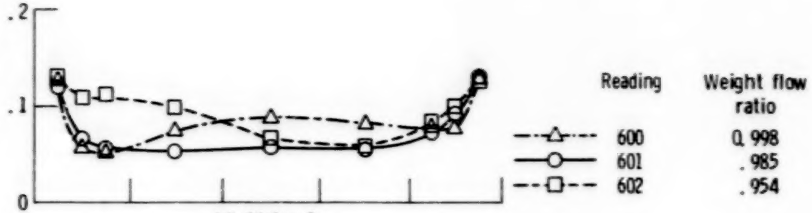


(c) Stator 9C; reading 1332; weight flow ratio, 0.968.

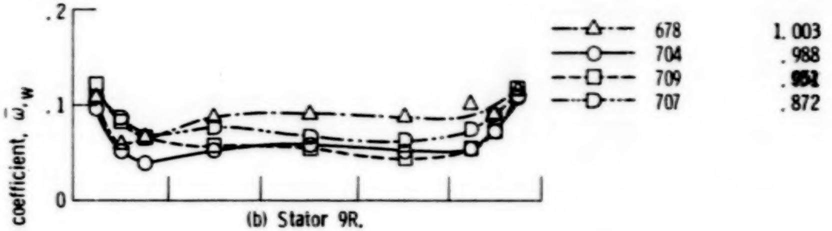


(d) Stator 9D; reading 3187; weight flow ratio, 0.986.

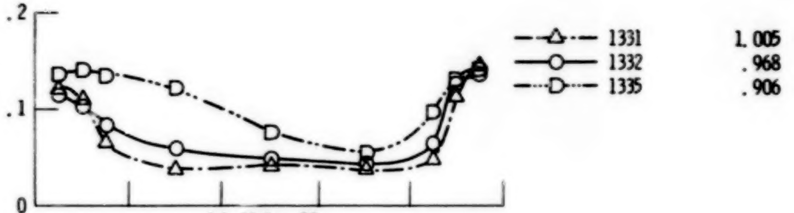
Figure 19. - Effect of free-stream total-pressure reference station on radial distribution of stator total-loss coefficient. Near peak stage efficiency at design speed.



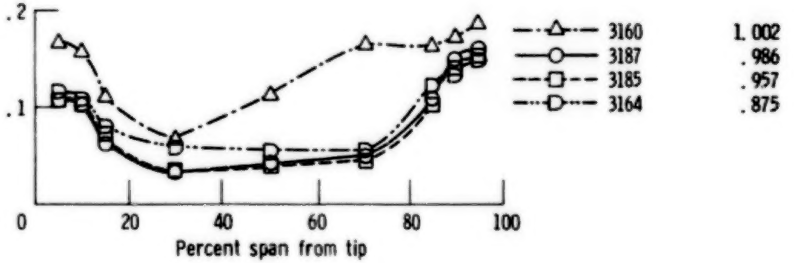
(a) Stator 9.



(b) Stator 9R.

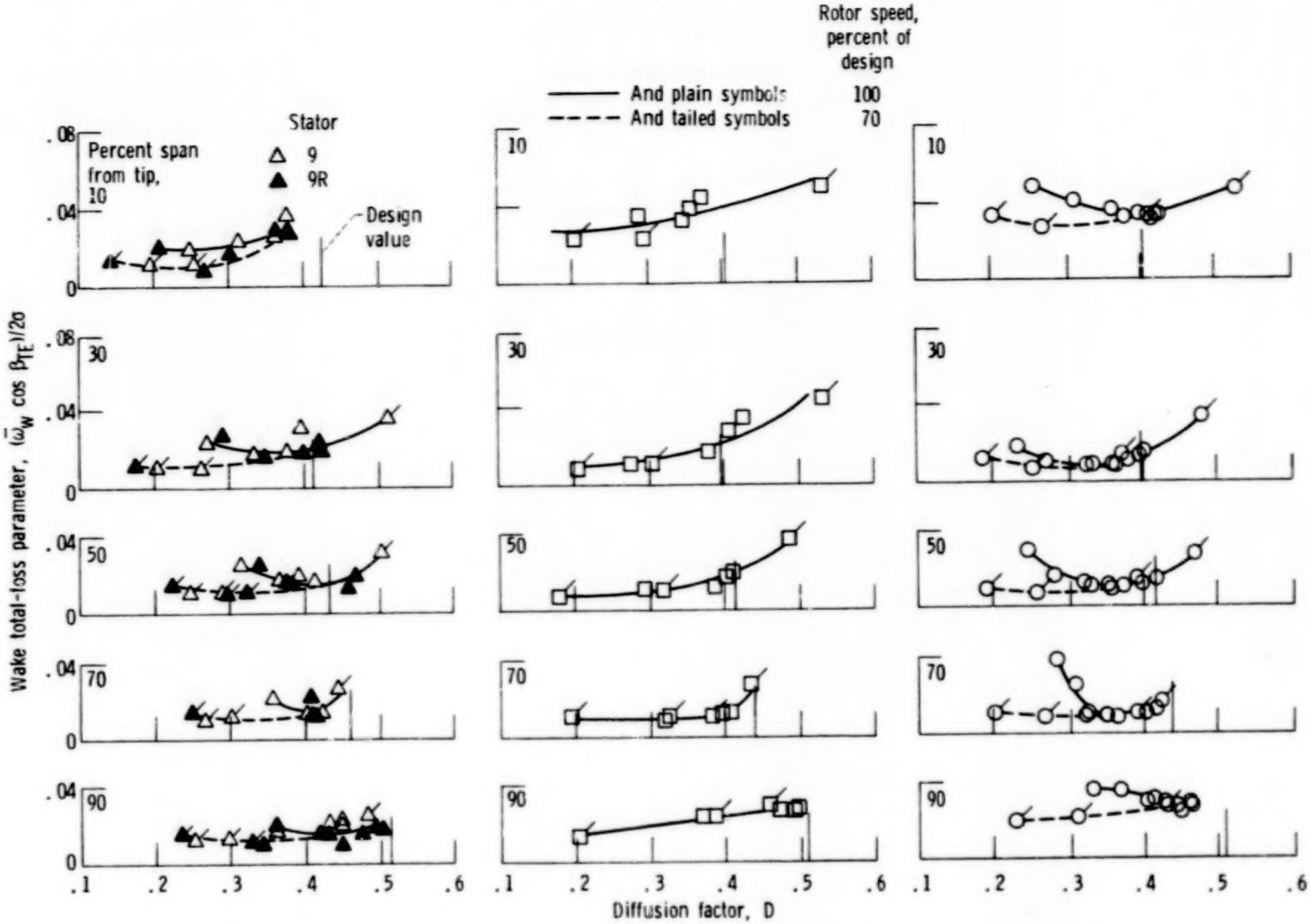


(c) Stator 9C.



(d) Stator 9D.

Figure 20. - Effect of weight flow on radial distribution of stator total-loss coefficient at design speed.



(a) Stators 9 and 9R.

(b) Stator 9C.

(c) Stator 9D.

Figure 21. - Effect of diffusion factor and spanwise location on total-loss parameter at 100 and 70 percent of design speed.

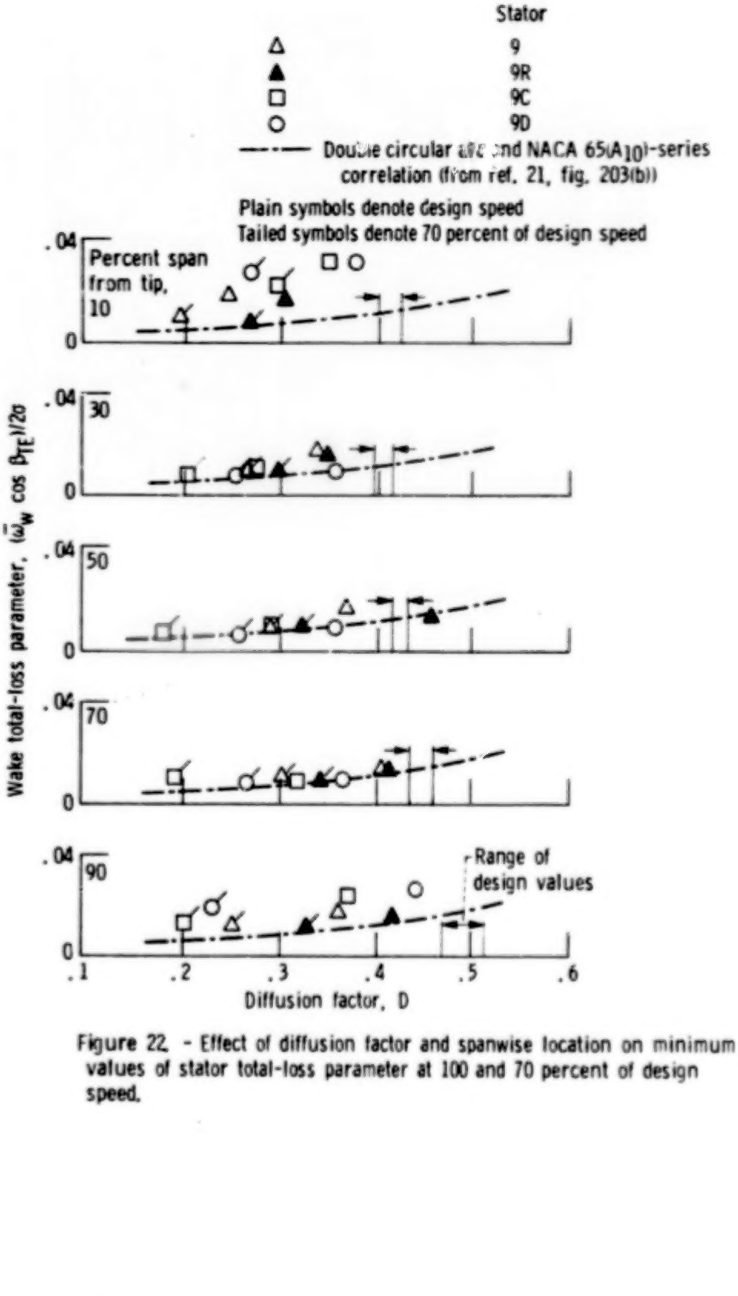
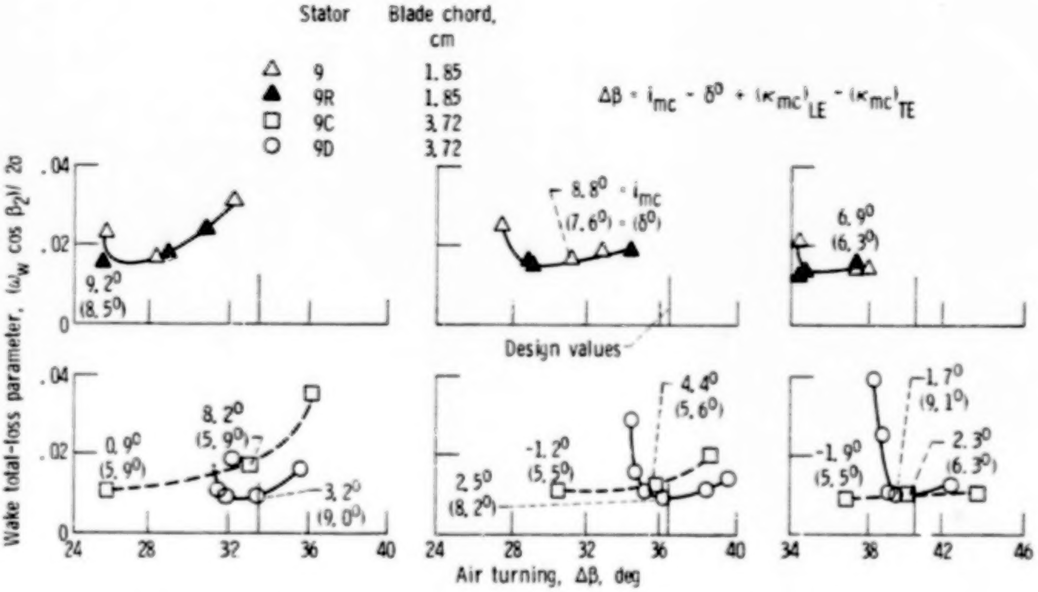


Figure 22. - Effect of diffusion factor and spanwise location on minimum values of stator total-loss parameter at 100 and 70 percent of design speed.

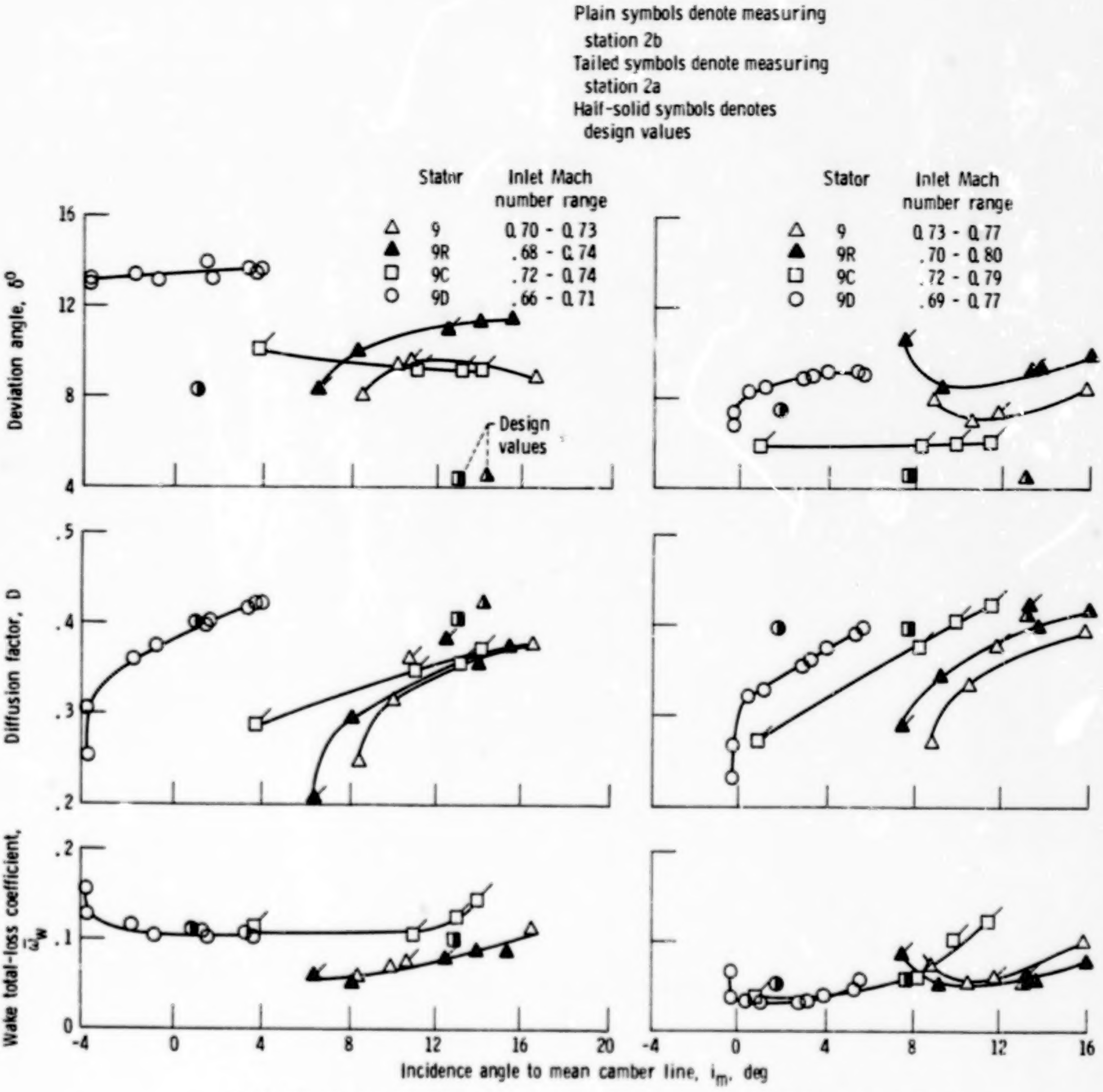


(a) 30 Percent span from tip.

(b) 50 Percent span from tip.

(c) 70 Percent span from tip.

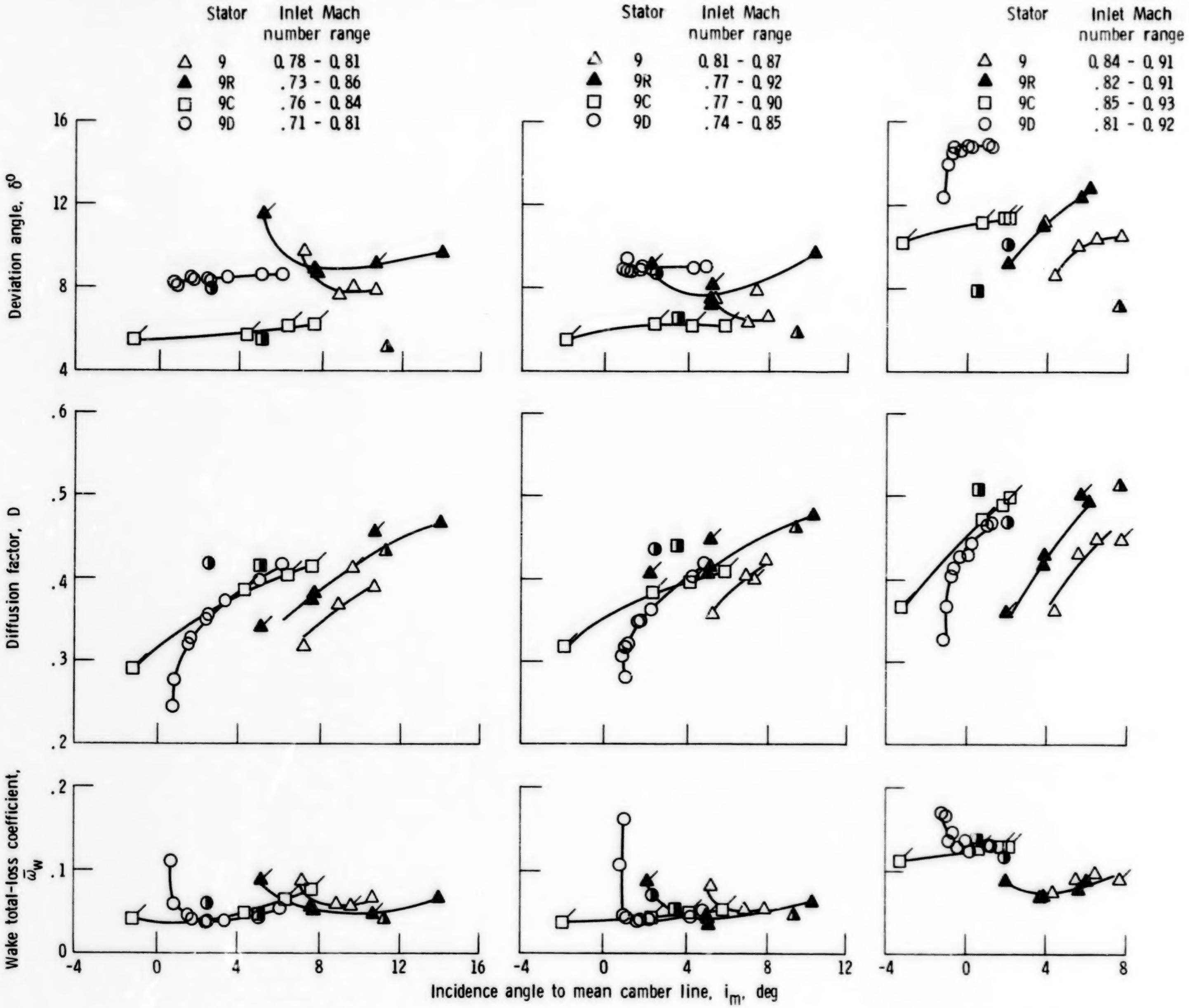
Figure 23. - Effect of air turning on total-loss parameter in midspan region of stators at design speed.



(a) 10 Percent span from tip.

(b) 30 Percent span from tip.

Figure 24. - Blade-element performance at design speed.

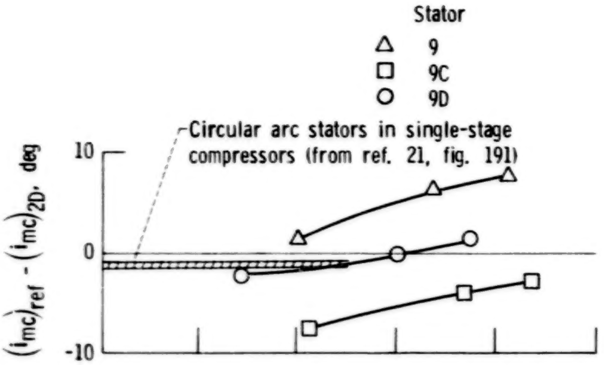


(c) 50 Percent span from tip.

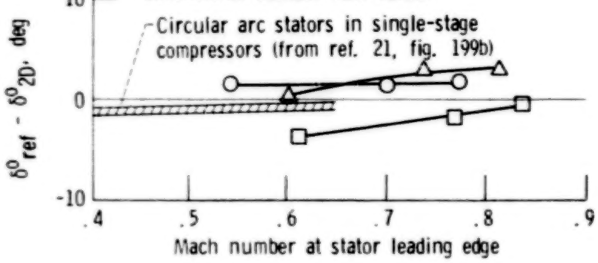
(d) 70 Percent span from tip.

(e) 90 Percent span from tip.

Figure 24. - Concluded.

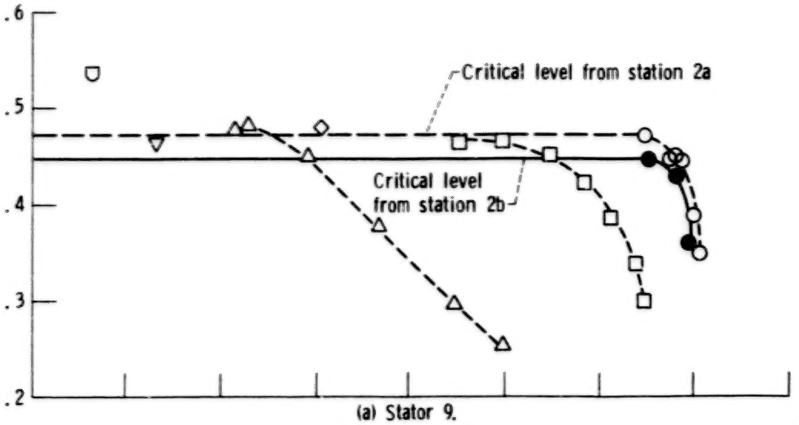


(a) Minimum loss incidence angle minus two-dimensional cascade rule value.

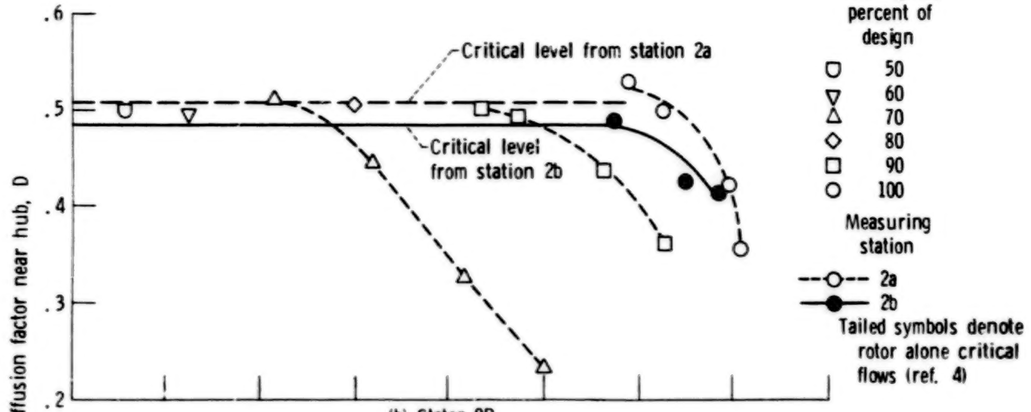


(b) Deviation angle at minimum loss minus two-dimensional cascade rule value using equivalent camber as defined in reference 15.

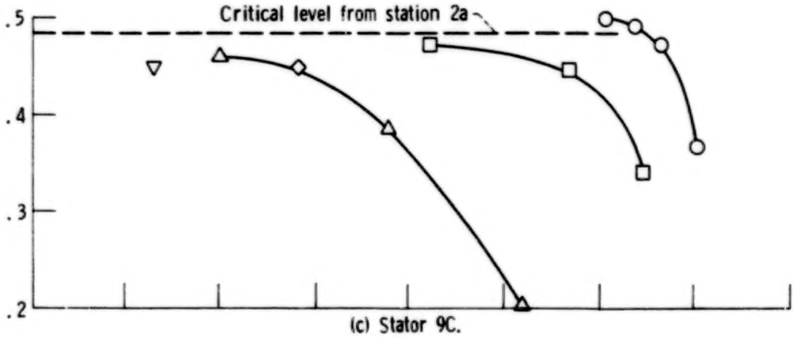
Figure 25. - Variation with Mach number of stator minimum-loss incidence angle and accompanying deviation angle at midspan, relative to a two-dimensional, low-speed cascade rule value from reference 21 (eqs. 279 and 281).



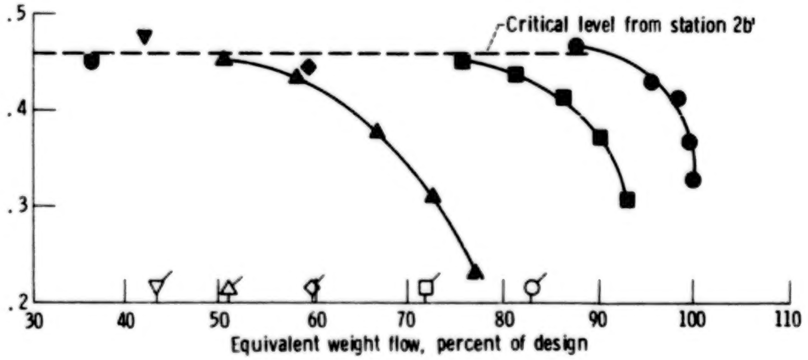
(a) Stator 9.



(b) Stator 9R.



(c) Stator 9C.



(d) Stator 9D.

Figure 26. - Stator loadings at 90 percent span from tip.

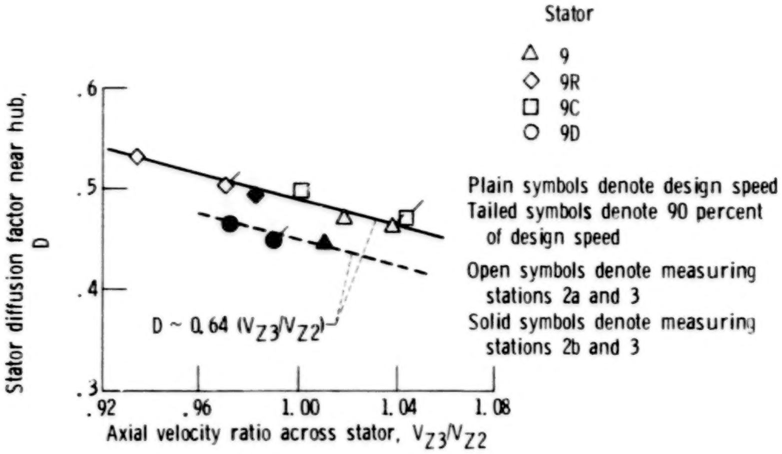
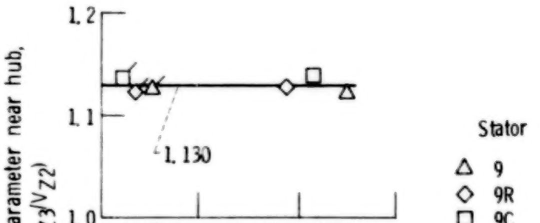
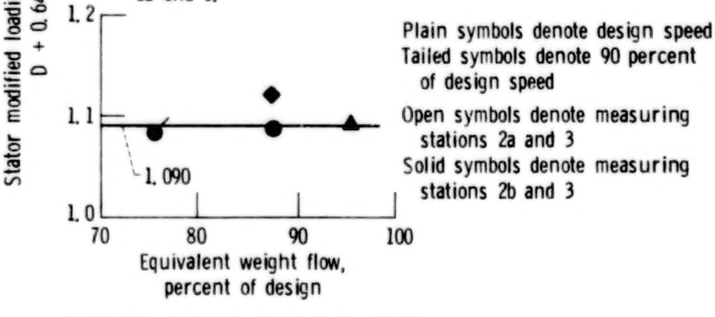


Figure 27. - Stator loading-axial velocity ratio relation near stall; 90 percent span from tip.



(a) From measuring stations 2a and 3.



(b) From measuring stations 2b and 3.

Figure 28. - Correlation of stator modified loading parameters near-stall; 90 percent span from tip.

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15. Supplementary Notes

16. Abstract

The aerodynamic performances of four stator-blade rows are presented and evaluated. The aerodynamic designs of two of these stators were compromised to reduce noise, a third design was not. On a calculated operating line passing through the design point pressure ratio, the best stator had overall pressure-ratio and efficiency decrements of 0.031 and 0.044, respectively, providing a stage pressure ratio of 1.483 and efficiency of 0.865. The other stators showed some correctable deficiencies due partly to the design compromises for noise. In the end-wall regions blade-element losses were significantly less for the shortest chord studied.

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